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December 5, 1918

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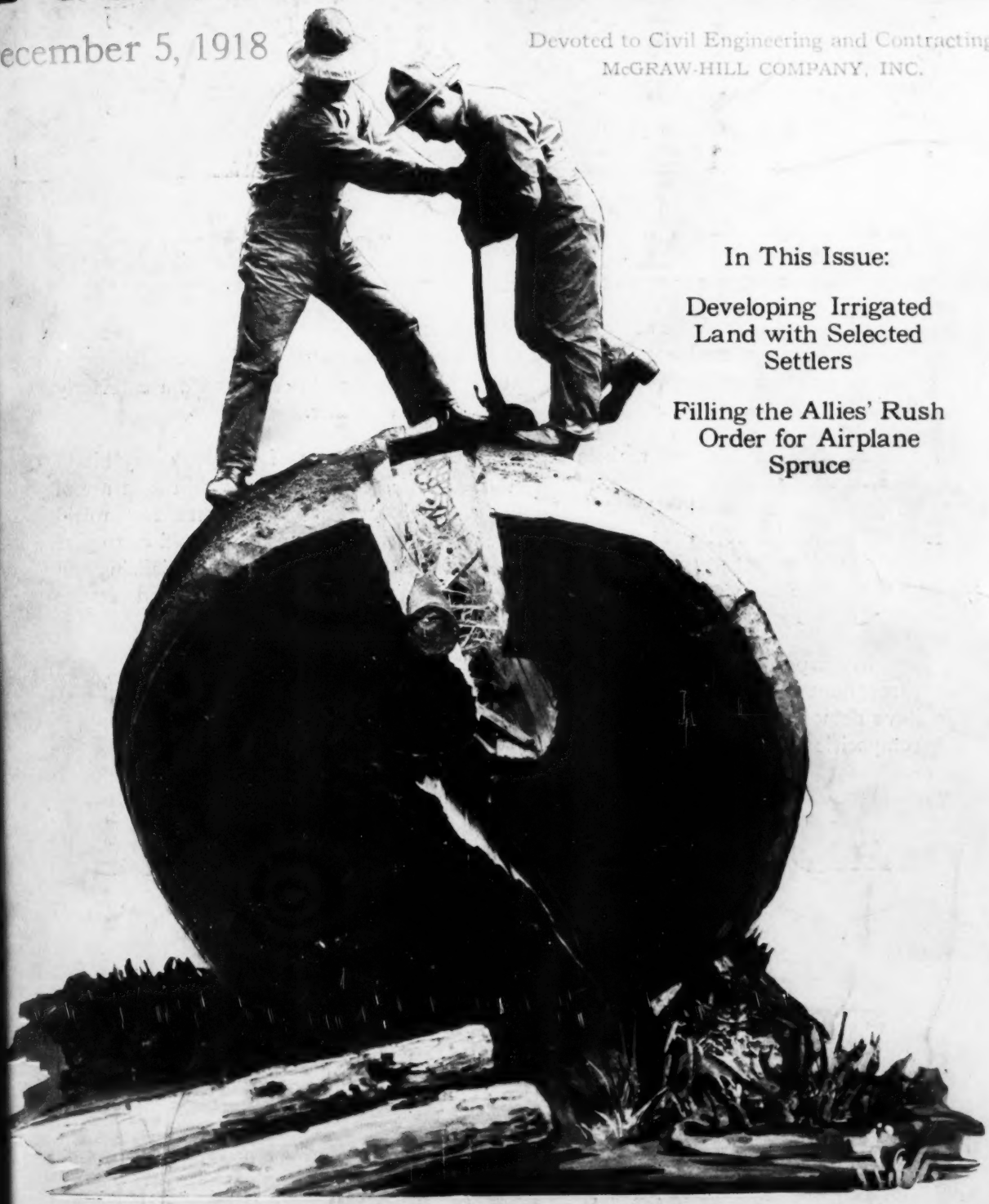


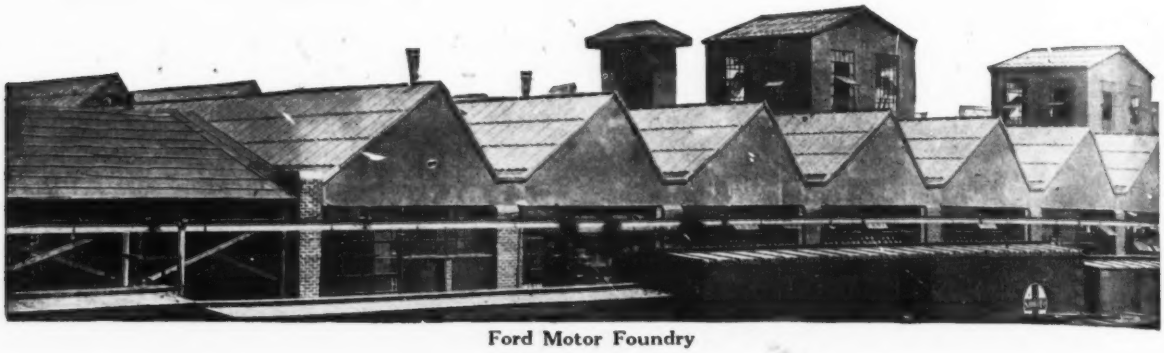
In This Issue:

Developing Irrigated Land with Selected Settlers

Filling the Allies' Rush Order for Airplane Spruce

First Step in the Production of Airplane Lumber—Splitting a Log in the Spruce Camps

I AM ONE OF MANY THOUSANDS



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Volume 81 December 5, 1918 Number 23

Engineering News-Record

A CONSOLIDATION OF ENGINEERING NEWS AND ENGINEERING RECORD, WITH WHICH IS INCORPORATED THE CONTRACTOR.

E. J. MEHREN, *Editor*
CHARLES WHITING BAKER, *Consulting Editor*

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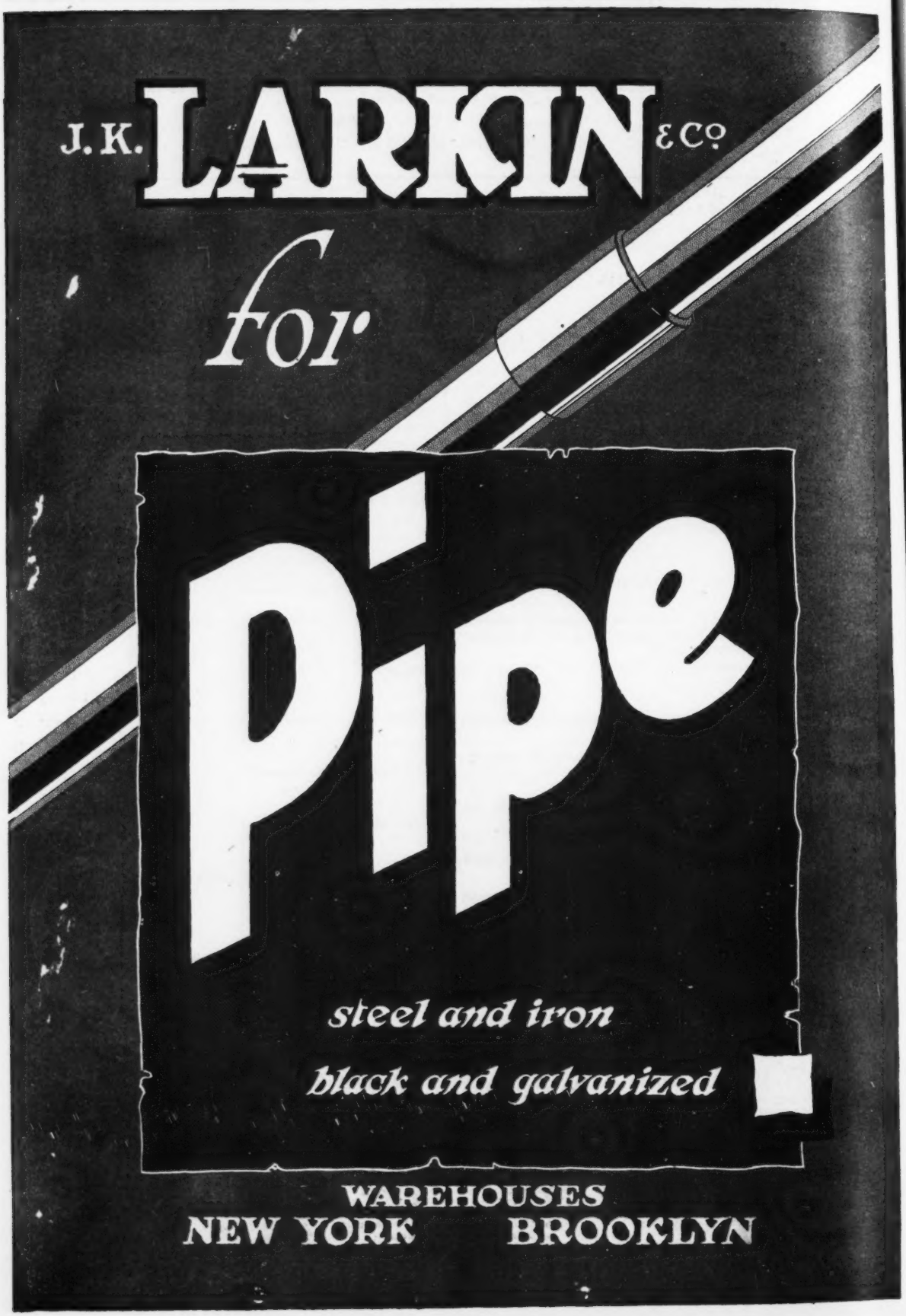
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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, Editor — CHARLES WHITING BAKER, Consulting Editor

Volume 81 — NEW YORK, THURSDAY, DECEMBER 5, 1918 — Number 23

The President and Public Ownership

PUBLIC ownership advocates, of the variety that sees the millenium in ownership of every public-service enterprise by the people, will find little consolation in the President's message to Congress last Monday. Far from indicating a leaning toward national ownership of the railroads, he stated that he should feel obliged to turn them back to private control before the statutory time has expired unless some policy far more convincing than any yet proposed is soon worked out. At the same time he deplored the alternative of a return in all fullness to pre-war conditions. Every right-thinking man will agree, we believe, in the hope that the President's threat of early return will result soon in the formulation of a policy which will allow the maximum benefit from coöperation, yet retain private ownership. The rapid formulation of such a policy should not, however, interfere with the return of the roads even before the statutory period has expired.

President Backs Land Reclamation Program

RECLAMATION of arid, swamp and cut-over timber lands as a prompt and effective way of providing work for those of our returning soldiers most in need of aid deservedly occupies a prominent place in President Wilson's message to Congress. His hearty indorsement of Secretary Lane's reclamation-reconstruction plans should meet with country-wide popular support, made effective by immediate Congressional legislation and appropriations and by similar state action where state and Federal coöperation is necessary. Engineers and engineering societies—local, state and national—can and should help in formulating plans and securing popular support for immediate land reclamation. Unless it be highway construction, nothing else promises such speedy and effective opportunity for the returning soldier, and it will at the same time be of far-reaching benefit to the country and to the world at large through increased agricultural production.

Teachings of Miles Acid Sewage Tests at New Haven

FRESH illustration of the limitations which hedge about every method of sewage treatment which has yet come to the front is afforded by the summary of the New Haven tests of the Miles acid process printed on p. 1034. Recovery of both grease and fertilizer is claimed for this process. As has happened so many times with other new processes, when this one was put to a commercial test serious difficulties arose. These pertain to the conversion of the grease to a utilizable form. Under New Haven conditions the advantages of the Miles acid process are held to offset the difficulties in grease treatment, but the implications are that in many other communities this would be far from the case. Other tests and further developments may broaden the chances for wide use of the process. Meanwhile, it may be regarded as worthy of further study but not as safe for adoption until after disinterested expert investigation, like that at New Haven, indicates that it will produce better results at lower costs than other methods adapted to given local conditions.

The Spruce Victory

A GREAT purpose and a great leader backed up by organized talent, team work and enthusiasm—that was the Spruce Production Division of the Army, with headquarters in Portland, Ore. Without actually seeing the results, it is hard to appreciate the importance to our war program of the work this organization was doing in the Pacific Northwest. Now, of course, like all other war agencies, it is being disbanded. Radically different methods of logging, and entirely new methods in the sawmill, were worked out by leaders unafraid to disregard precedent. Out of their fresh and broader view came enormous increases in total production of spruce and—what is still more important—an almost unbelievable improvement in the quality of the product. The thick spruce stands of the inaccessible regions have been tapped by railroads—thirteen of them—located, built and operating in less than a year, and a new goal of practically doubling the present output was recently announced. Popular attention during the year has been elsewhere, and the men in the Spruce Production Division have been too busy to tell of their work, if they would. Therefore, little is generally known of problems and successes that under other conditions would have had world-wide publicity. This would have been particularly true in engineering circles, because of the engineering pioneering involved. The policy of putting engineering problems in the hands of engineers has been followed by General Disque from the outset, and too much praise cannot be given him for his methods of management. His farsighted analysis of the spruce production problems and his ability in handling men have made him the greatest single factor in the success attained. Now, that the work is closing down it is a pleasure to record the achievements and to give to General Disque and his colleagues the credit they so richly deserve.

Effective Use of Our Merchant Marine

WE DO not believe that many thinking citizens of this country need to be convinced further that the retention in American hands of our new merchant marine, and its operation on terms that will permit of competition with foreign nations, are necessary for the future prosperity of our country. Nevertheless, the support of competent authority is always helpful in strengthening us in our beliefs. We find these words in an address by Stevenson Taylor, president of the Society of Naval Architects and Marine Engineers, before the twenty-fifth annual meeting of that body: "It is incredible that any administration of the United States Government shall sacrifice the great funds and efforts, individual and collective, that have been expended in the past two years to build up facilities, to educate men—and women, too,—in order that we may have and operate ships of our own; and if there are laws upon our statute books that prevent our reasonable operation of ships they must be amended; if our loading, unloading and other port facilities are not what they should be, they must be changed; if there is anything which interferes with our progress upon the seas, it must be removed and if there is anything yet lacking to advance this progress, even Government ownership, or private ownership aided by a judicious government, it must be developed not for the advantage of any section or coast, but for the needs and advantages of our whole nation."

Cabinet Attitude on a National Highway System

ENGINEERS and contractors, particularly those interested in highway work, will look upon Secretary Houston's statement of Nov. 27 as one of the most important that has ever been made concerning our highway problem. The secretary, after discussing state and Federal expenditures for road work, added: "Still, it seems to me that we should take a further step. . . . It would be in the public interest to make available larger appropriations from the Federal treasury to be used *separately* or in conjunction with state or local support." The important word in this statement is the word "separately," which we have taken the liberty to put in italics. Later in the interview the secretary stated that he had canvassed his various suggestions regarding highway work with the President, the Secretary of War, and the Postmaster General, and had found them in accord with regard to the appropriation of additional funds. He does not say in the latter connection that he specifically canvassed the matter of separate expenditure of funds by the Federal Government, but it is presumed from the context that such was the case.

The statement does not commit the secretary to the policy of building a national highway system, but, by considering it as an alternative of Federal aid, he shows at least that he is not averse to such a proposal. The Government's attitude in the past has been strongly set against a national highway system, to be built and maintained by Federal funds. In thus taking a step forward, the President and his cabinet advisers are merely reading, and reading aright, not only the public demand but the new conditions which have made necessary the adoption of a policy of national highway construction. *Engineering News-Record* in the past has been opposed to a national system, but the new conditions introduced by motor trucking have so changed the situation as to leave no doubt of the necessity of completing the highway net of the country by adding to our county and state systems a national system tying in the various states just as efficiently as rail lines now do for the bulk of our transportation.

Secretary Houston's views lend added importance to the highway congress which will convene under the joint auspices of the American Association of State Highway Officials and the Highway Industries Association in Chicago next week. The subject will be among the other broad questions of policy discussed. The meeting, taking its cue from Secretary Houston, should do much to crystallize the nation's thinking on highway work, particularly as to the advisability of building a national highway system.

The New Industrial Consciousness

OUT of the chaos of building a great war machine there is emerging one highly desirable result, not evident so long as munitions of war engrossed the attention of most industrial leaders, but now becoming evident. This is the strengthening of our great industries by a closer relation of those engaged in them. Heretofore, with a few exceptions, fear of our laws prohibiting the partial coöperation within industries which other countries found most helpful, and ample markets developing steadily under the existing methods of business warfare, checked the development of business association within the industries. Then the war-time needs suddenly changed the entire relations of manufacturers among themselves. The administration found that many of the things Congress had prohibited were absolutely essential for the maximum service from the railroads, and those prohibitory laws fell on the scrap heap. In order to send munitions to Europe on General Pershing's schedule, the War Industries Board forgot the Sherman law and all other laws, called together the representatives of each essential industry, and told them to work together to increase their output. In other cases, the same procedure was followed to make non-essential industries curtail their output, in order that materials, fuel, labor and transportation might be saved for more essential purposes.

The administration has been knitting together the members of each great industrial group. They have learned to coöperate for the nation's benefit and to their own good. They are now facing the great strain of reconstruction, and of their own volition many of them are reaching the conclusion that what the administration found necessary in war the industries will find helpful in peace. The American Iron and Steel Institute and the Portland Cement Association long ago proved their industrial usefulness to those who came in contact with them. It required war conditions to show to the nation their value in swinging great industries as units into the service of the country.

Perhaps the most significant development of this idea recently has been in the oil industry. Fifteen years ago

there began a timorous groping toward some kind of recognition of the possibility that competing producers were not necessarily business pirates. Local associations arose from time to time, but it took the war to demonstrate clearly that a strong national oil-producers' association was necessary to coördinate the development of our petroleum resources on a sound basis. The National Petroleum War Service Committee will undoubtedly be succeeded by some organization adapted to normal conditions. Other industries, not so prominent but of great significance in the nation's life, have now the same opportunity and the same incentive to get together, in order that a united effort may be made for their welfare, and for the elimination of all the waste of time, energy and money due to independent, uncoördinated endeavor to accomplish reforms only successful when comprising an entire industry.

An Engineering Failure

WHEN the public is served as it was in the recent moving of several very heavy viaduct girders through the streets of New York, as reported in the news columns of Nov. 7 and discussed in this issue (p. 1041) by an eye-witness, the engineering profession has little cause to take pride in the performance. Needless to say, the damage need not have occurred, for the art of construction has ample means at its command to build a simple viaduct in more conservative manner. That it should not have been allowed to occur is no less obvious; certainly from the standpoint of the public the injury to property and the accompanying danger to public security should have been prevented at almost any cost.

Not only were asphalt pavements, manhole structures and tracks injured, and a large gas main ruptured, but the risk of much more serious damage was present during the trucking. These results must be charged either to a serious lack of prevision or to a faulty view of relative costs—weighing a saving in erection expense against the risk of damage and menace to safety incurred in trucking extraordinary loads through the streets.

It is clear that the public's interest was left unprotected. Blame for this rests solely upon the engineer; the contractor's part in the matter may be left out of consideration, since his work was in all respects under the direction of the engineer. Most remarkable, perhaps, is the fact that the engineering bureau which was in charge of the viaduct construction, and therefore responsible for the trucking, the city's Bureau of Highways, damaged public property which was intrusted to its own care. A more thorough failure of trusteeship to the community can hardly be conceived. But, even apart from this special relationship of trust, the engineer's disregard of the public interest is a matter of the most serious concern. No obligation is more urgent than that imposed by his duties to the community in which he lives.

Modern construction is able to meet most varied requirements as to strength, weight and space. No branch of the whole art is as highly developed in this regard as steel construction. Structures may be built of straight or of curved members, of large or of small units. Columns and girders may be constructed integrally or in sections built together at the place of erection, without sacrifice of service qualities. With such means at his command, the structural engineer is under obligations to use them not only to suit the technical requirements of his structure but also to serve the interests of public convenience and safety. He cannot plead the justification of necessity when he plans to erect in the heart of a city a structure of ponderous steel units that create danger and cause destruction while being moved to the site.

What advantage was gained by avoiding field splices in the girders is not apparent. The method pursued involved very great expense. Unquestionably it was more costly than its alternative, even apart from the matter of property damage. And in addition it entailed grave risk of causing interruptions of vital public services. Yet it will not produce a better finished structure.

Thus, the primary failure must be traced back to the design. Its source, no doubt, lay in lack of prevision; the work was studied more with regard to the structure than to the processes lying between the project and its final realization. Similar lack of prevision, however, must be charged against the engineering represented in supervision and execution, for in each stage the results should have been foreseen.

The most serious effect of the undertaking, we believe, is not the material damage done—to the public—but the harm done to the engineering profession itself. Citizens and taxpayers noting the facts of the case are bound to conceive a distrust of engineering skill. They may fairly conclude that the art of construction has progressed but little beyond that primitive stage when its works involved the expenditure of life as well as money. Such an operation as the present one, therefore, jeopardizes the asset of public confidence and good will which the engineering profession has built up through a long history of successful achievement.

The Port Problem of the Future

EVERY sign points to a tremendous future for the United States upon the ocean. The demands of a world starved of commodities for four years, the establishment of a shipbuilding industry that cannot be allowed to die, and the revived habit of the sea which our country lost with the passing of the clipper ship, all call for a merchant marine capable of winning its share of the world's free markets. How to develop successfully that merchant marine is one of the many problems of today. The questions of seamen's laws, Government ownership or subsidy, efficiency of ship construction and operation, and the design and control of ports, all have to be studied and answered in the next few years. The problem of the port is, above all, one which calls for engineering thought and action.

In the restricted sense in which it has been attacked in the past, the port problem is merely the problem of the terminal. It resolves itself into reducing to the lowest terms the cost of getting goods off and on a ship. As in all other forms of transportation, this cost forms the major part of the total charge against the movement of freight. So haphazard has been the development of the ports of this country, so careless the general attitude

toward foreign trade, that so far as methods of handling are concerned there is not a major port in the country which could not be completely revamped with profit. Moreover, whether it be the result of railway domination of the water front, the vicissitudes of political control, or the inevitable congestion resulting from disordered development, port layout, too, is in need of general revision.

The various local port authorities realize the situation today; from nearly every city on the Atlantic, Gulf, and Pacific coasts come reports of bond issues, port-commission studies, and actual construction work, all looking toward the material improvement of the port facilities to meet the coming increase in foreign trade. It can be confidently expected that the new designs and construction which will surely come in the next few years will be far in advance of the existing facilities. As a result, we may look forward to a material reduction in the cost of transferring freight to and from ships.

Unfortunately, however, the best mechanical equipment or engineering design does not itself attract business, as several of our leading secondary ports can testify. In so far as it reduces the cost of transferring freight which does come to the port it is an advantage, and one on which the local authorities can hardly spend too much time and effort. But the port can no longer be considered merely as a mechanical terminal. It must be treated as a link in a grand transportation system stretching from every store and factory in this country to and from the landing quays and docks of every foreign port.

As such, its economical operation, with the consequent reduction in cost of foreign trade, passes beyond the control of local port authorities and becomes a national problem. Here, then, is the critical element in the future problem of the port. How are we to have the necessary independence of the port itself, that initiative of construction and operation which only local pride and business necessity can secure, and at the same time preserve some Federal control over the freight routes which will give a maximum two-way cargo for the ship and a minimum land carriage for the ocean-directed freight? With Government operation or even control of our merchant marine there is inevitably connected the problem of most efficient use, and that involves all the factors that are here considered.

So long as war conditions prevail, the Federal government through the Railroad Administration and the Shipping Board can exercise this control, and can parcel out the business to the various ports on the basis of what they consider national economy, regardless of local profits. As soon as the war-recovery period is over, however, the country will be face to face with the alternative of a possible political control which all Government direction invites, or local port administration which does not look beyond the benefits to its own immediate district.

Somewhere between the two must lie the solution. Ocean-carrying costs must be reduced to the lowest limit, if the United States is to meet competition. Local business initiative should not be limited. The day of railroad dominance of our ports is past, and the scientific routing of freight, based on a sure knowledge of the origins and destinations of various commodities, will supersede the artificial routing which has largely prevailed. The opportunities for the presentation of the essential facts on which the new order must be built lie with the combined engineering and business talent of the country.

Contractors Undertake Unification of Construction Industry

UNIFICATION of the construction industry is the reconstruction task undertaken by organized contracting. Two weeks ago, in Chicago, addressing the Associated General Contractors of America, Brig. Gen. R. C. Marshall, Jr., director of war construction contracts amounting to over a billion and a quarter dollars, enjoined these duties upon the new society: To affiliate employers and workmen in the construction industry; to bring equal responsibility into the relations between owner and contractor; to join the engineer and the contractor into a partnership of mutual confidence. Can organized contracting bring about these results? The spirit of the Chicago convention answered, Yes. And we, knowing the contractors of the country, heartily subscribe to the same belief.

By the mere fact that it sets itself high ideals an organization takes on strength. No higher ideals were ever accepted than these of unifying the construction industry of America. Schism has always characterized this industry. The engineer has set himself apart from the contractor, and the owner has held jealous guard against the rights of both. Against all stood labor. This is not because workmen or contractors or engineers or owners are naturally dishonest, but because they have let their relations with each other become perverted. Unification of the construction industry is primarily the problem of eliminating the evil from the relations between owner, engineer, contractor and workmen. Can organized contracting find the common denominator of the opposing factors?

In a typical speech John F. O'Rourke, veteran engineer and contractor, defined the contractor as "the man who draws together the materials and the artisanship which create the structures which the engineer draws." Incidentally, this thought was repeated by Col. W. A. Starrett, chairman of the Committee on Emergency Construction of the War Industries Board, when he defined the contractor as a collective expert. As collective experts, Mr. O'Rourke asserted, contractors have peculiar talents for accomplishing unification because, besides having in common with the engineer knowledge of length, breadth and thickness, they know also the fourth dimension of cost. Though uttered jocularly, this thought embraces profound truth.

Mutual recompense is the common denominator of the trinity of problems which General Marshall set organized contracting. Lack of vital concern for, if not actual indifference to, mutual compensation for labor expended is the cause of every serious difference between owner, engineer, contractor and workmen in the construction industry. Our war construction has taught this lesson thoroughly. No such construction task as has been performed for war in the past eighteen months could have been accomplished with so little friction between the traditional enemies in the construction in-

dustry, had not a contractual relationship which assured mutual recompense been established at the outset.

Organized contracting can unify the construction industry. Every delegate of the Associated General Contractors of America left the convention hall in Chicago convinced of this fact. Every delegate left with the knowledge that assured mutual recompense for labor expended was the common denominator of the factors of the problem. If contractors will rally to this standard, set high at the Chicago convention, we shall before long look back on that meeting as a milestone in the progress of the construction industry.

The Most Hopeful Experiment in the Settlement of Irrigated Lands

FOR years our arid states and the Federal Government have been grappling with the problem of failures on irrigation projects. In many cases unscrupulous or incompetent promoters were at fault. But even on the Government's own work, where there is no suspicion of improper methods, there have been lamentable failures. There has been much investigation, and the errors are now pretty well known. It has remained, however, for the State of California to put in hand the first experiment in this country which strikes at the roots of the evil. That experiment, the most hopeful thing agriculturally that has been done in the United States in many a year, is described in an article on p. 1014 of this issue. Aside from its bearing on problems that have long been with us, it is pertinent today for the possibilities it shows of land settlement in the reconstruction period.

Briefly, the chief evils in our past methods of irrigated-land settlement have been the admission of plainly unqualified settlers to the projects, and the failure to give them, on private projects, any disinterested or expert advice. In the admission of unqualified settlers the public projects have been quite as much at fault as those under private control. California's approach to the problem has been, first, to insist that plainly disqualified applicants be rejected, and second, to afford the settler, both before taking land and after entering upon it, every assistance that expert agencies of the state and Federal Governments are able to furnish.

In rejecting those evidently unfitted, the California Land Settlement Board has done what other Government agencies have declared to be impossible—discriminate among citizens in the apportionment of the Government's bounty. The fear has been that political pressure would be brought to bear, or that the disgruntled would disparage the management and wreck the enterprise. The California board has stood solidly on the ground that the admission of the disqualified was an injustice to them and, on account of the economic waste, to the state itself. Such is the confidence reposed in the board that there has been no criticism of its selective work. When we hark back to the selective principle at the base of our civil-service law, we wonder why this precedent was not sufficient to give courage, before this experiment, for the application of the principle to land settlement.

It must not be thought that any board can pick prospective successes in 100 per cent. of the cases. There will probably be some failures, no matter how careful the scrutiny. The percentage of these, however, will be very greatly reduced by the expert counsel placed at the disposal of the settlers.

The second great feature of the experiment is the utilization for the benefit of the settler of all the available and qualified expert agencies. The Reclamation Service has done much in the way of community organization, but its work has started only after the settler has come on the project, and even then is not as complete as in the Durham effort. California calls in its experts at the very start, when the land is subdivided and valued. The settler knows exactly what he is buying, and the values are fixed with all factors in mind. How well the valuation work has been done is shown by the applications for the second allotment at Durham. Every tract was first choice of at least one applicant. In other words, taking into consideration the kind of soil, the distance from the village, the lay of the land, price, etc., every tract appealed to someone as the most desirable. Such conduct of its work gives promise of a strong hold by the Land Settlement Board on the confidence of California's agricultural interests.

There are additional merits of the scheme—the elimination of exorbitant commissions, the loaning of money for improvements, etc.—all interesting and important, but comment need not be made on them here.

Two other aspects of the experiment, however, should not be overlooked. At the minute we are deeply concerned with the problem of giving our returned soldiers as large an opportunity as possible. Many are to be re-inducted into industry. Some will prefer the farm, and to these the nation, either alone or in coöperation with the states, should offer an opportunity for becoming independent. It still holds true that an agricultural community composed of strong, independent men is the backbone of any nation. The California development points the way for assisting these men. Something more will have to be added in the way of financing, but this could readily be supplied by paying the men for their work in developing the irrigated units and adding this cost to the lands the same men buy later.

The other aspect is that in this time of mental fluidity, when a sense of responsibility to the nation still rests in the hearts of all classes, we can, even in the Eastern states, by proper leadership, show what can be accomplished by agricultural coöperation and the assistance of expert agricultural agencies. There is not a state in the Union which cannot find undeveloped tracts of land and corresponding numbers among the returned soldiers who would be glad to take them up if a proper system of financing could be arranged. A boy from the Eastern states will not look with enthusiasm upon a transfer to the arid West. Some few venturesome ones may want the novelty of pioneering in a new country, but most of them will prefer to remain in familiar surroundings. The national interest would be served by Congressional appropriations which, in coöperation with the states, would start a new era of land settlement in the Eastern states.

In all of these directions the California experiment shows a hopeful way. Its interest transcends the boundary of that state; its lessons are a contribution to the solution of a national problem.

Developing Irrigated Land with Selected Settlers

In California Experiment, Real Estate Sharks Have Been Eliminated and Expert Agencies Called in To Help Sales Problems

IT HAS been recognized during the past five years that the greatest problems in the development of irrigated lands are not technical, but human. On recent private projects effort has been expended almost entirely on building the works and selling the lands to anyone who had the price, the developer trying to "get from under" as rapidly as possible. In many places the methods of selling were unscrupulous, the commissions absorbed a large part of the purchase price, and the settler was left with worthless land or inadequate works. On public projects the unscrupulous features were removed, but care was not exercised to exclude those who plainly lacked the qualities necessary for success.

California has taken the first step in the United States in the adoption of an intelligent settlement policy. Its work has progressed far enough to give an indication of results—and the results are excellent and encouraging. Briefly stated, the aim of the experiment is *to give deserving and qualified persons assistance in acquiring small, improved farms, and to demonstrate the value of adequate capital and organized direction in subdividing and preparing agricultural land for settlement.* The method of selecting the settlers, rejecting the obviously unfit, is the most interesting feature of the whole experiment.

Inception of Plan—The experiment was inaugurated because a study, made by direction of the California legislature, of the conditions of settlers in colonies inaugurated by private enterprise, showed the heavy loss which individuals had sustained through the methods in vogue. It showed that the colonization companies had made no study of the kind of agriculture suited to a particular locality, and no effort to determine the capital the settler must have or the conditions essential to his success. In every case the time allowed for payment was too short; the settler that could make the initial payment was accepted, regardless of the condition in which it left him. This report made it apparent that private land settlement was a failure, that this failure was not due to lack of resources, and that it could have been prevented had the projects been under competent direction and if the settlers had received expert and disinterested advice.

ALFALFA SEEDED BY LAND BOARD BEFORE LAND WAS SOLD MAKES FARM PRODUCTIVE THE FIRST YEAR

Pursuant to the recommendations of the committee which made the study, composed of Dr. Elwood Mead, director of rural institutions in the University of California, chairman; Mortimer Fleishhacker, president of the Anglo-California Trust Co.; David H. Barrows, professor of political science in the University of California; Harris Weinstock, a merchant of Sacramento, and Chester A. Rowe, editor of the Fresno *Republican*, the legislature in 1917 passed the Land Settlement Act, providing funds for the purchase of lands and their development and disposal to settlers under the direction of a State Land Settlement Board, created by the act. The sum of $260,000 was placed at the disposal of the board as a loan, all of the moneys to be repaid to the state in 50 years, the board to pay the state treasury 4% interest on such of the funds as was used. The board appointed consisted of Dr. Mead, as chairman, ex-Senator Frank P. Flint, a lawyer; W. B. Langdon, a judge; Mortimer Fleishhacker, a banker, and P. F. Coggswell, a farmer.

The Durham Tract

Some 40 tracts of land were offered to the board, and after competent examination two tracts at Durham (near Chico), in the Sacramento Valley, were selected as the most satisfactory for initial development. The tracts totaled 6219 acres, were partly under cultivation, and had water rights on Butte Creek. Ditches, of a more or less satisfactory sort, had been dug to parts of the land. There were no farmsteads. The terms of purchase by the land board permit of payment for the property in 20 years. Under such conditions of purchase the board can acquire a considerable area of land with the available funds, and still have sufficient money for the building of the necessary irrigation structures, for loans to settlers, etc. The cost of the land to the board was $100 per acre.

Before purchasing the tracts, the board settled a water-right litigation of five years' standing on Butte Creek, by inducing all the holders of rights to agree as to their respective interests, and have this entered as a decree by the court. Once the land was purchased, the procedure of the board was to call to its aid every established agency that could render expert assistance. The sanitary experts of the university reported that the irrigation of the land might cause malarial troubles if the mosquito were not eliminated, and the county supervisors therefore created a mosquito-abatement district embracing not only these lands but a large surrounding area. The statistical expert of the Prudential Insurance Co., in a recent address in San Francisco, said

that the preliminary arrangements to insure the health of this settlement were the most enlightened and efficient of which he had any knowledge in this or in any other country. The soils experts of the Agricultural College of the University of California made a soil map which was used in the subdivision of the land and the determination of the sizes and value of farms. The professors of animal husbandry and agronomy helped work out the kind of agriculture best suited to the locality. The drainage and irrigation scheme was prepared by the engineers of the Office of Public Roads and Rural Engineering of the Federal Department of Agriculture, and the designs for houses and farm buildings were made in a large measure by the architectural bureau of the California State Engineer's office. In other words, agencies created by the state and paid by the state and Federal governments were given an opportunity to use their knowledge and experience in constructive planning, and as a result the farmers of the community have the benefit of this cumulative knowledge and experience.

In making the soil map, samples were taken at such intervals as was necessary to make an accurate map of the whole area. With this in hand the sizes of the farms were determined so as to give considerable choice to intending settlers, keeping each farm within such limits that one family with one farm-hand could take care of it. As a consequence, the farms with the richer land are the smaller, while the poorer lands were laid out in rather large units, running as high as 160 acres. In some cases a tract of this poorer land went with a small tract—say 15 or 20 acres—of the rich land, the two tracts sometimes not being contiguous. The units having rich land only ran from 30 to 50 acres.

Financial Features—The prices per acre were fixed with due consideration to all influencing factors, such as character of soil, roughness, accessibility, etc. The character of the soil caused the chief variation in price, the survey disclosing the fact that practically no two tracts were exactly alike. The prices in the first settlement varied from $60 to $235 per acre, and the total price of units from $3600 to $13,600. The average selling price was $150 per acre, this increase over the purchase price being made to cover the overhead expenses, the irrigation improvements, etc. The terms of purchase were, 5% down and 5% each year on the principal until paid, with 5% interest on the unpaid balance. In other words, the settler pays out in 20 years. In order to remove the heavy burden of the higher interest amount in the earlier years, the payments are scaled down as to payment on principal, so that the semi-annual payments are the same throughout the period.

Where there were improvements on the property, the settler had to pay 40% of the value, the balance to be paid in installments extending over 20 years. On both land and improvements settlers might make a larger initial payment, or might pay off more than one installment on any interest date after five years.

In the first tract to be opened there were 63 farms and 21 farm laborers' allotments, the latter consisting of home plots of either 1½ or 2 acres each. All were taken up, and the applications outnumbered the units available. The farm workers' allotments sold for $400 each. The object of these farm-laborers' plots is to furnish satisfactory living conditions for farm laborers and their families, and thus encourage them to stay in the country. Moreover, these men were selected because they were sober, clean-living men, good and skilled workers who would, with their families, form a congenial element in the community life as well as provide needed help in its agriculture.

Selection of Settlers

The method of selection of the settlers is the most interesting feature of the whole experiment. In the past, private enterprises were not concerned with the qualifications or condition of the settler other than his ability to pay for his purchase, while the managers of public enterprises feared the disrupting influence of charges of favoritism that might be made by disgruntled rejected applicants. The board, however, took the position that it was an injustice to the individual and to the state to admit to the project men whose records, character or conditions indicated likelihood of failure.

Therefore, the procedure was adopted of following the careful examination of the applicant's record with a personal interview. Those thought best qualified, all factors being considered, were selected, and those rejected were told plainly the reasons for the failure of the board to allot units to them. Such was the confidence in the board's fairness that *no complaints have been registered and no political pressure has been brought to bear.*

Besides taking into consideration the settler's practical knowledge, industry and character, to which great weight were given, the board required that the settler should have a minimum capital of $1500 or the equivalent in implements and livestock. Twenty-five hundred to three thousand dollars was considered a better sum for an allotment of 40 acres or over. There was no maximum limit set on the money a settler might have, but the law required that he must not be the holder of agricultural lands elsewhere to the value of $15,000, or that by this purchase his land holdings should not be made to exceed $15,000 in value. As a matter of fact, the settlers on the first allotment at Durham had an average of $3000 in cash and $7000 in total assets.

The farm laborers' allotments could be taken up by men of experience, industry and character without capital qualification other than the amount of the initial payment, $20. There were many applications for these allotments from city folk and other inexperienced persons, but in all cases the allotments were assigned to experienced, capable laborers. These, in the first settlement, included five carpenters, two market gardeners and a shoemaker.

A residence qualification is fixed for the settlers, as well as restrictions with reference to the sale or mortgaging of the lands. An applicant must enter upon actual residence within six months, and must continue *to reside on the farm for at least eight months in each calendar year for at least 10 years from the date of approval of his application, unless prevented by illness, or he presents some other reason satisfactory to the board.* Moreover, no allotment may be transferred, assigned, mortgaged or sublet in whole or in part within five years after the date of sale without the consent of the

board, given in writing. At the expiration of five years, if all the conditions of the contract have been complied with, the purchaser may, with the written consent of the board, dispose of or mortgage the property. In the event of the failure of the settler to comply with any of the terms of his contract, the board shall have the right to cancel the contract, and all the payments made thereon shall be deemed rental paid for the occupancy.

Assistance to Settlers—Owing to the amount of detail involved in organization, in selecting the land, taking title, etc., following upon the passage of the act, it was not possible to throw the first lands open to settlement until June of this year. In order not to lose a season therefore, the board leveled, plowed and seeded as much of the land as possible. Settlers might buy these crops or not, as they wished. Most of the new owners bought the crops, paying the land board the cost of preparation and seeding, and managed to clear from those crops from $300 to $1400 per unit. The land board, from crops not taken, netted $2000.

RESOURCES OF LAND BOARD ALLOW EQUIPMENT SUCH AS THIS TO BE USED FOR BENEFIT OF SETTLER ON ALLOTMENT

Immediately upon taking title, each applicant had an opportunity to confer with a representative of the department of farmstead engineering, created by the board, as to the layout of his farm, the location of the farmstead and the design of the buildings. As a result, the department has made a farmstead and field layout for each unit. The barns are of uniform design but varying size, but the houses differ in accordance with the requirements and tastes of the owners. Under the law, the state may loan $3000 to a settler, but not in excess of 60% of the value of the improvements or other security. Probably one-third of the settlers will apply for building loans, the others having sufficient capital to take care of their own building improvements. Even where they have sufficient capital without recourse to loans, the buildings are being erected for them under contract by the land board, which is buying all of the building material at wholesale, thus reducing the cost to the settlers. All loans carry 5% interest. The repayment of building loans may be spread over as many as 20 years, but loans on livestock and implements must be repaid in five years.

In contrast with the liberal terms allowed by the land board, it should be noted that throughout the West banks charge as high as 9% on crop and stock mortgages, and farmers frequently pay 12% for short-time loans, and often cannot borrow money on any terms.

Coöperative Efforts—A constitution and bylaws of a coöperative stock breeders' association, based on those of Denmark and Wisconsin, was prepared by the board, and all settlers who intended to become stock raisers were required to become members of this association and to conform to its requirements. One of these conditions was that nothing but pure-bred animals should be used in the settlement, and that the sires should be mainly owned by the association rather than by individuals. There was to be one breed of dairy cattle, one breed of beef cattle, one breed of hogs and two breeds of sheep. Holsteins have been adopted as the dairy breed, Shorthorns as the beef breed, Duroc Jerseys as the breed of hogs, and Rambouillet and Romney Marsh as the breeds of sheep. The settlers promptly organized and elected Prof. G. H. True, professor of animal husbandry in the university, as the head of their executive committee, and appointed a buying committee of three. That committee has secured one bull of unsurpassed breeding at one-half of the price that would have been paid if he had been bought under ordinary commercial conditions, and Fred Kiesel, a banker of Sacramento, has given the settlement the pick of the yearling bulls from his fine Holstein herd. Several of the settlers have bought cows from one of the noted herds in the state having unusually high milking records. They have bought as a community the breeding herd of a noted breeder of Duroc Jerseys, the herd being sold on the owner's death by the administrator.

Coöperation In Other Lines

Such has been the general confidence in the livestock association that it has already been turned into a general coöperative association, and has bought for the community seed potatoes for next spring, alfalfa seed, lime, fencing, and numerous other farm materials. The start that the settlement has already made gives assurance that it is soon to have a reputation for pure-bred animals, and can sell livestock on its pedigree value and greatly increase the farmer's income. Every animal that enters the settlement is tested for tuberculosis, and the hogs are protected from cholera by inoculation.

In order to get agreement on these matters, the old-style town meeting has been revived, and has created a fine community spirit in the settlement.

It is the ambition of the land board that there may be established at Durham or on the settlement lands a training school in agriculture. There will be between

400 and 500 children in the settlement, and the farms will furnish them with opportunity for observation and study, to supplement the work done on the school grounds. Twenty-two acres of a beautiful old grove have been set aside for community purposes. On this will soon be built a social hall that will be a center for recreation as well as more serious gatherings.

The Second Tract

Applications for lands in the second tract purchased were closed Nov. 20. In order to have these lands made ready for settlers the board purchased a 70-hp. caterpillar traction engine and two platform plows, and has hired another 7-hp. tractor to cultivate the land for the settlers. It was only in this way that the land could be made ready for seeding at the proper time, because of the dryness of last summer. The settlers could not have afforded the tractors, and horses or tractors of ordinary size were wholly inadequate. The ability to bring to community development ample financial assistance will give to this new community an income from the farms twelve months earlier than it could otherwise have been obtained, and will mean an addition to the grain crop of the state of the produce of not less than 1000 acres.

There are 31 farms and five farm laborers' allotments in the second unit. As in the first instance, all the farms were applied for, but in this second settlement something unusual occurred. Every farm in the settlement was the first choice of some applicant. This is a high testimonial to the judgment of those who valued the farms. The price of the land in the different units varied from $48 to $235 an acre, the endeavor being to make them all equally attractive, balancing all factors —and the effort has succeeded. The results here were better than in the first settlement, because in that some of the plots were neglected, while there were 10 to 14 applicants, in portions of the second, for each farm. In the second settlement there are certain farms that are attractive, from location or appearance, that were applied for by a large number, but every farm was the first choice of some individual.

The fact that these farms on a single area vary from $48 to five times that sum per acre shows how unscientific and unfair is the Government practice of making no discrimination in the conditions on which farms on the public domain are obtained. This shows especially in irrigated sections. One homestead on the public domain may be worth five times as much as another, because the one of uneven surface will cost five times as much to level as the one made ready by nature for the plow and irrigation ditch—yet the Government makes no distinction between them, thereby perpetrating great economic injustice. This example of Durham ought to lead to a reform in the Federal land settlement laws.

Financial Status of Project

It is interesting to examine the balance sheet of the State Land Settlement Board at the end of its first year of operation, June 30, 1918. Up to that time the board had drawn from the state treasury $196,000, and with the net value of the liens held by it on property disposed of to settlers—less, of course, its indebtedness for land purchases—showed a surplus of $176,000. It is further important to note that all of the administrative expenses involved in buying, valuing, laying out and disposing of the first lot of units was only $5918. Had the scheme been privately developed, the selling commissions alone would have approximated $75,000. In other words, the settlers are getting their land at cost, know in advance through careful soil surveys the exact character of the lands they are purchasing, and have the best advice available, all without paying tribute to the real-estate shark, who has in the past exacted high commissions and has not given them any assistance or any guarantee as to the character of the soil.

Some notion also of the impression the experiment has made in California is evidenced by the fact that a syndicate of bankers holding some 70,000 acres of land, which was offered to the board when the land settlement scheme was first proposed, have again come to the board with their property, offering not only to sell it to the state on 20-year terms, but in addition to loan the land board funds for aiding settlers to develop the property. The land board, being favorably impressed with the tract, consented to reconsider it, but suggested that, instead of the haggling customary in land deals, the land board appoint a committee of three recognized experts—men who would command the confidence of the entire agricultural community of California—to value the lands. This the owners agreed to. The three men selected could not agree on a report, though each one, separately and individually, and for a set of reasons all his own, had arrived at the same figure as to the value of the property. It was stipulated, when the suggestion was made by the land board, that neither party bind itself to the figure that would be determined upon by the experts, but that their report would furnish a basis of confidence for the prospective settlers if the state should take the lands. The owners had held the land at a figure somewhat higher than that determined by the committee of experts, but upon receipt of the three individual reports modified their offer to the state and accepted the experts' figures. Though the deal has not been closed, there is good reason to expect that the proposition will be accepted and that the land board will proceed to develop this larger propery.

FARM HOUSE ON ONE OF THE DURHAM ALLOTMENTS

The California experiment, then, seems largely to have passed the experimental stage. It is true that the settlers have not paid out and that the scheme is only

in its first year. But the project is settled by experienced farmers and men of character who have sufficient financial resources to work through the development period. In addition, the scheme has been started on such intelligent lines that the land board has won the confidence of the settlers and of the people of California.

Problems Before the Civil Engineers' Society

Three Alternative Plans of Organization and Their Logical Results are Discussed—More Representative Form Inevitable

By Gardner S. Williams
Ann Arbor, Mich.

THE development committee of the American Society of Civil Engineers met at the rooms of the Western Society in Chicago, Nov. 14, and spent three days in deliberation, adjourning to assemble in New York during the week of the annual meeting of the society. Of a total membership of 29, twenty-six members were in attendance, representing 17 states and 23 localities. The membership, which covered territory from Boston to Los Angeles, and from Duluth to New Orleans, was unanimously in favor of an extension of the functions of the society, but when it came to the details of a plan —*confined to the American Society of Civil Engineers*— the ideas seemed hardly to have passed beyond the nebular stage.

The conception of some central engineering body around which or under whose leadership all the engineers of the country could be gathered was clearly uppermost in the mind, but just what was to be its relation to the American Society of Civil Engineers, or what the relation of that society to it was to be, no one seemed prepared to state. The sentiment was also very clear among the members selected by the local associations that those associations must be recognized by the governing body to a much greater extent in the future than has been the case in the past. A considerable inclination toward the combination of all societies in a particular locality under some coöperative organization, and an impression favorable to the development of some type of student membership, were also apparent. Comparatively little thought, seemingly, had been given to the development of the technical functions of the society, and if President Talbot, in an address to the committee, had not directed attention to this subject, it might easily have been overlooked.

The main idea of the committee, as evidenced by the discussions, was not distinguishable from that which has animated the two conferences on coöperation held in Chicago in 1917 and 1918.

Three Possible Lines of Action

While ideas are still in a nebulous, or as one member of the committee suggested, in an amorphous state, it may be well to indicate some possible lines of action, and, from the views expressed, there are suggested the following three. It should be borne in mind that this discussion proceeds from the point of view of the American Society of Civil Engineers, and not from that of the profession as a whole.

First, the merging of the four great national societies into a single organization, a truly national society of engineers, around which shall be gathered all the other national engineering and allied associations, and the state and local societies.

The swing of the pendulum, in this highly specialized age, away from specialization is not unexpected, and while, from the point of view of technology, there are natural distinctions between civil, mechanical, electrical and mining engineers, when it comes to the consideration of their civic duties, their responsibilities to their fellow citizens and to the public at large, these differences disappear. The obligations of citizenship rest alike on the section-hand and the railroad president.

The query is, Can it be done, and if so, is it desirable?

Second, the creation of a central organization charged particularly with the care of the interests of the profession at large, in which body not only the national but the state and local societies shall have representation, but in which each element will preserve its own identity. In other words, a republican institution. Whether in such an organization the representatives of national societies shall form a senate and those of state and local societies a house of representatives, to draw a parallel from our National Government, or whether all delegates shall stand on an equal footing, are details upon which no general opinion was expressed. The feasibility of such a program was generally accepted, but comment on the failure thus far of the Engineering Council to measure up to its opportunity was neither infrequent, nor altogether apologetic, and while the fact was recognized by all that engineers as individuals have done a wonderful work in the war, it was also felt very keenly that the profession as a body had very little in the way of collective achievement of which to be proud.

Third, assuming the creation of a central organization as above contemplated, it was suggested that such an organization naturally would have very little time or inclination to deal with technical matters. It might be wise for the American Society of Civil Engineers, it was suggested, to devote itself chiefly to the scientific problems before the engineering world, and assume that its members would, through other organizations—national, state and local—exert their desired influence upon the central organization. The remarkable development of the American Society for Testing Materials affords evidence of the demand for purely technical work, and the possibility of the less difficult and more popular exercise of public-service functions overshadowing and crowding out the scientific spirit is to be considered. On the other hand, it was maintained by some that local associations devoted wholly to the scientific cannot live.

Under some one or another of the foregoing three propositions is probably to be found that to which the American Society of Civil Engineers must turn, and the query now is, Which?

Logical Result of These Plans

Whichever one of these alternatives be adopted, or even if another and unthought-of organization be worked out, it must involve local associations; and the one immediate and definite step that can be taken is

to establish the relation that must exist between the local and the national body.

The parent society occupies a position not dissimilar from that of the British Parliament, for while it is endeavoring to be a national society and to deal with the problems of national import, it is also discharging the functions of a local association for New York City and its immediate environs, just as the British Parliament, while administering the affairs of the empire, devotes a large part of its time and energy to the local government of England, Scotland, Wales and Ireland.

Any comprehensive plan of representative government demands a change in this situation. The members within 20 miles of the postoffice of New York cannot be the national society, but must find their place in a New York or metropolitan local association on exactly the same terms as do the Philadelphia, San Francisco or St. Louis members. As a further step to a representative government based on local associations, it follows that every member of the national society must become a member of some local association. When this is accomplished the directors of the society can and should be elected by the associations in their districts, and the president and other officers at large. It will easily follow that candidates for admission to the society must first be accepted by the local association with which they are to become affiliated, before coming to the consideration of the national governing body. The next step in the program is to provide for the setting apart of a certain portion of the dues of every member, for the use of the local association. When these principles will have been adopted the American Society of Civil Engineers will have become truly national.

The remaining question to be considered is the relation of the local association to other local societies in its district. The experience of the St. Louis and Philadelphia associations, and some of the Western associations, affords a reliable guide at least for the initial program, and will not be discussed here.

To summarize, in the writer's present opinion four things are essential to the nationalizing of the society:

1. The establishment of local associations in New York and Boston, and the separation of national and local affairs in the society.
2. The assignment of every member to some local association.
3. The election of directors and the passing upon membership by the local associations.
4. The assignment to the local associations of a sufficient part of the receipts from dues to enable them to maintain themselves without a further tax upon their members.

Wave Pressure on Ships Does Not Follow Hydrostatic Laws

Preliminary Tests by Emergency Fleet Corporation Give Information of Value in Ship Stress Determination

(Passed by Publication Approval Committee, Emergency Fleet Corporation)

OBSERVATIONS taken in a special testing station at Atlantic City by F. R. McMillan of the concrete ship division of the Emergency Fleet Corporation have shown that within the limited range of possible observation it is not correct to assume that pressure on the side of a ship is equal to the hydrostatic head of the wave. There seems to be a dragging effect of the moving water which reduces pressure at the crest and increases it at the trough. If these observations are confirmed in further tests the knowledge gained should have considerable effect on the current analysis of hull stresses, in which the actual hydrostatic heads of an assumed trochoidal wave are used in moment calculation.

The testing station, located on one of the ocean piers, employed instruments which gave synchronous and continuous records of wave height and water pressure. These instruments were developed by Professor McMillan for concrete ship stress determination, and were first installed on the concrete freighter "Faith" for her initial voyage. They are being further developed in connection with continuous recording strain gages, for the investigation of stresses in the new Government concrete ships.

With these instruments it was possible to make continuous pressure and height records at 2, 6, 10 and 14 ft. depth below the average water surface, and on waves up to a length of 175 ft. and a depth of 4 ft. Most of the results were on wave lengths from 85 to 135 ft. The seas were what might be called choppy, and as such not considered indicative of general conditions at sea. The object of the experiments was to determine whether the pressure at any point below the surface of a wave is equal to the static head represented by the depth at that point, and, if it is not equal to the static head, to determine what relation exists between pressure and wave height. The conclusions over the limited extent of the tests is that at the crest of the wave the pressure is less than the static pressure, and at the trough it is greater. The variation of pressure under any given point during the passage of the wave is less than the static equivalent of the wave height, the actual ratio varying from 60 to 70 per cent.

Further studies on a more elaborate scale are being planned, but for the present it is assumed that the pressure reduction is due to the hydraulic action of the moving wave. That is, at the crest of the wave the water moving upward exerts an upward thrust which tends to reduce the downward pressure due to the height of the water. At the trough the downward-moving water increases the static head. The tendency is thus toward equalizing the extremes of pressure.

County Organizations for Forest Fire Control

Twenty-four counties in California have adopted a plan of organization for rural fire control. In these counties, covering 16,000 square miles, 412 rural fire-fighting companies have been organized and now include about 6500 men, according to a summary of the situation recently made by the University of California. By the aid of 532 automobile trailers, which have been purchased and equipped with fire extinguishers and fire-fighting tools at county expense, these companies have kept losses from fire at a remarkable low figure in the past season.

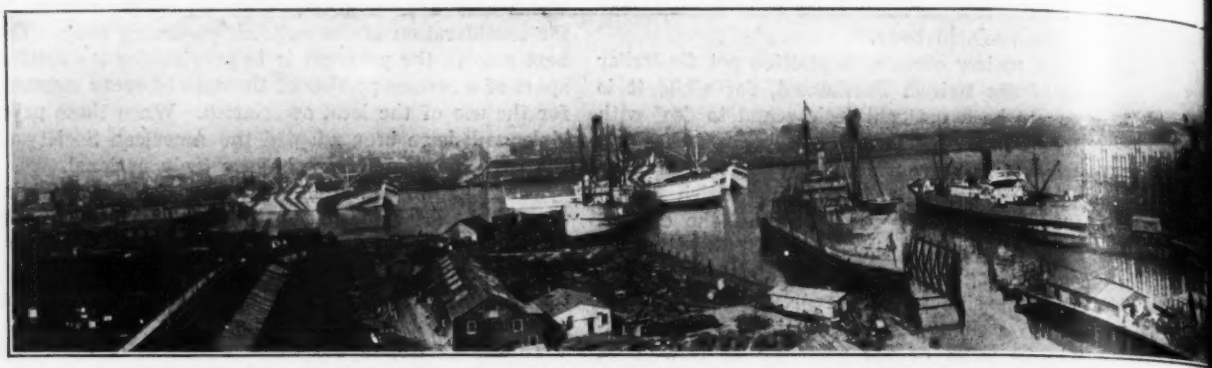


FIG. 1. PANORAMIC VIEW OF BETHLEHEM SHIPBUILDING CORPORATION 6-WAY YARD AT ALAMEDA, CAL.

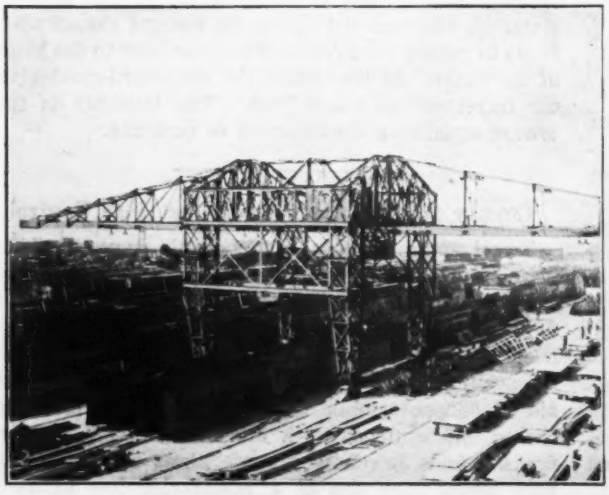
Handling Shipbuilding Material at Alameda Shipyard

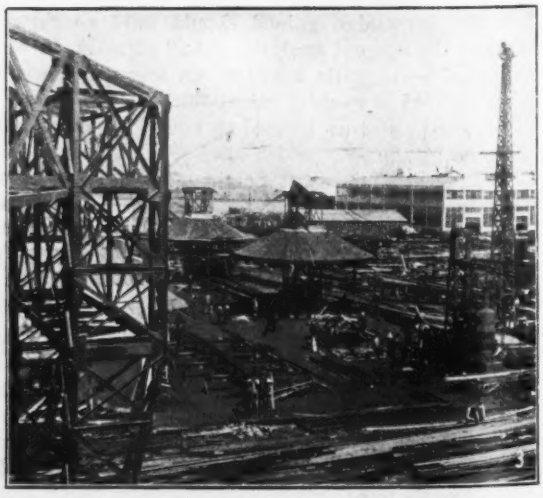
Planned for Direct Routing—Three Craneways in Fabricating Shop—Shape Shop in the Open—Turret Cranes at Shipbuilding Berths—Assembly Yard

DIRECT routing of materials and speed in handling them are notable features of the Alameda, Cal., plant of the Bethlehem Shipbuilding Corporation. The company has contracts on a cost-plus basis for 12,000-ton steel vessels, and is working at capacity speed on six ways. The layout of the yard is notable in the general allotment of cranes and all material-handling devices. Ample space for present and future needs was provided, but it is significant that there is only very limited storage space for finished material. This is so because it was the intention to equip and man the plant so that material could go directly into the hull as fast as it was ready.

The plate and shape storage yard is served by four standard-gage tracks. Plates are taken from the cars and stored at the upper end of the yard (see plan, Fig. 6); the shape section is at the lower end. Two gantry cranes are used on a track paralleling the railroad tracks, one serving the plate storage and the other the shape section, although both can be used at either end of the yard if desired. These gantries have a span of 165 ft. from end to end of the arms. The outer arms extend over one of the railroad tracks, and thus can deliver material from the cars direct to the plate-marking area or to the racks, as desired. On the side of these large gantries, next to the structures in which are located the mold loft and templet storage, two one-leg gantries operate beneath the arms of the larger cranes. The small cranes serve plates to horses in the templet yard, where they are marked for punching and shearing. It is typical of the California yards that this space is not roofed over.

From the templet yard plates pass into the shop on small flat-cars. The shop is divided into two bays, each served by overhead cranes on three runways side by side. The bay nearer the templet yard contains the smaller and lighter machines, while the second bay is laid out for handling the larger plates and the heavier work. In each bay there is an electrically operated crane, on the central track, which delivers incoming plates to the machines. A number of hand-operated cranes on the two outer tracks are used for serving the plates at each machine or for transferring to adjacent machines.



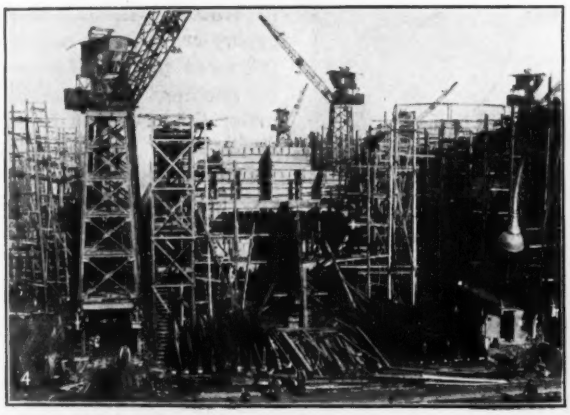


FIGS. 2 AND 3. STORAGE AND SHAPE FABRICATION AT ALAMEDA—GANTRY CANTILEVERS SPAN CARS, RACKS, AND MARKING AREA; SHAPES WORKED IN THE OPEN UNDER "UMBRELLA" RIG

FOUR OLD WAYS IN THE CENTER, PLATE SHOP TO THE RIGHT, TWO NEW WAYS IN THE BACKGROUND

The machines are ranged along either side of the bay beneath the outer or hand-operated cranes. Thus, as a plate comes into the shop it can go down one side of the aisleway, being successively sheared and punched on one side only. It may then be returned from machine to machine on the opposite side of the bay for punching and shearing on the other side, or it may be brought back through the same machines in the reverse order, after being turned. Under this plan it is never necessary to turn a plate more than once, and it has been found that one man and helper are sufficient for each machine even with the heaviest plates and when the pay is on a piecework basis.

"Umbrella rigs" shelter the outdoor machines. Such a rig consists of a structural-steel column supporting a roof, without walls, which shelters the machine. Each corner of the column supports two radial jib cranes which swing through about 150°. The upper crane is considerably longer and heavier than the one below, so that for larger or more complicated pieces the lifting can be done by the large crane while the lower one adjusts the piece and holds it in position for the machine.



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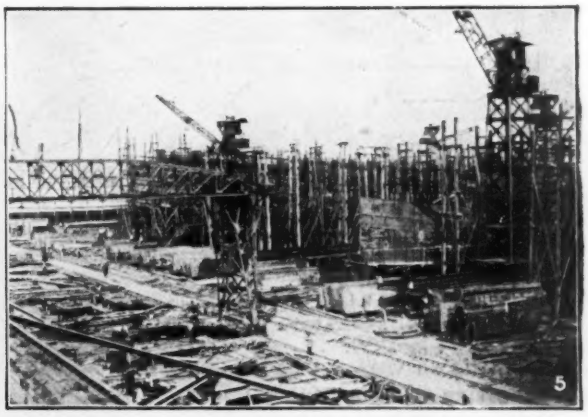

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FIGS. 4 AND 5. FABRICATED STORAGE AND ASSEMBLY AT ALAMEDA—LITTLE SPACE AVAILABLE FOR STORING FINISHED MATERIAL ALONG HEAD OF WAYS; ASSEMBLY YARD BETWEEN PLATE SHOP AND WAYS, WHERE TURRET CRANES CAN REACH FOR MATERIAL

The extent to which the skill of the workmen affects plate-shop capacity is shown by the fact that early in July the shop was turning out about 1200 tons per week, while during the last week in September, with practically the same crew, it produced 1928 tons, the increase being attributable to the skill of the workmen developing with experience.

Shape fabrication differs from the plate work in being done outdoors. All shearing, punching and planing of shapes are done in the open and the only operations carried on indoors are hot and cold bending. For the latter purpose two 60-ft. oil furnaces are used, besides the usual cold rolls. This constitutes a very flexible and convenient arrangement well adapted to the climatic conditions of California.

The punching and shearing machines are so located that on either line of progress through the shape yard successive machines alternate in vertical and horizontal arrangement. That is, when a shape requires punching or shearing on both sides it is passed along from one machine to the next instead of being turned to afford access to the other side. The shape yard includes a 500-ton hydraulic joggling press for odd shaping work.

The yard has six ways, 400 to 500 ft. long, served by turret cranes. Originally there was only one crane on each track. This was found inadequate, and on the first four ways another crane was added to the tracks between the ways, leaving the outer tracks with only one way. When two more ways were added to the yard

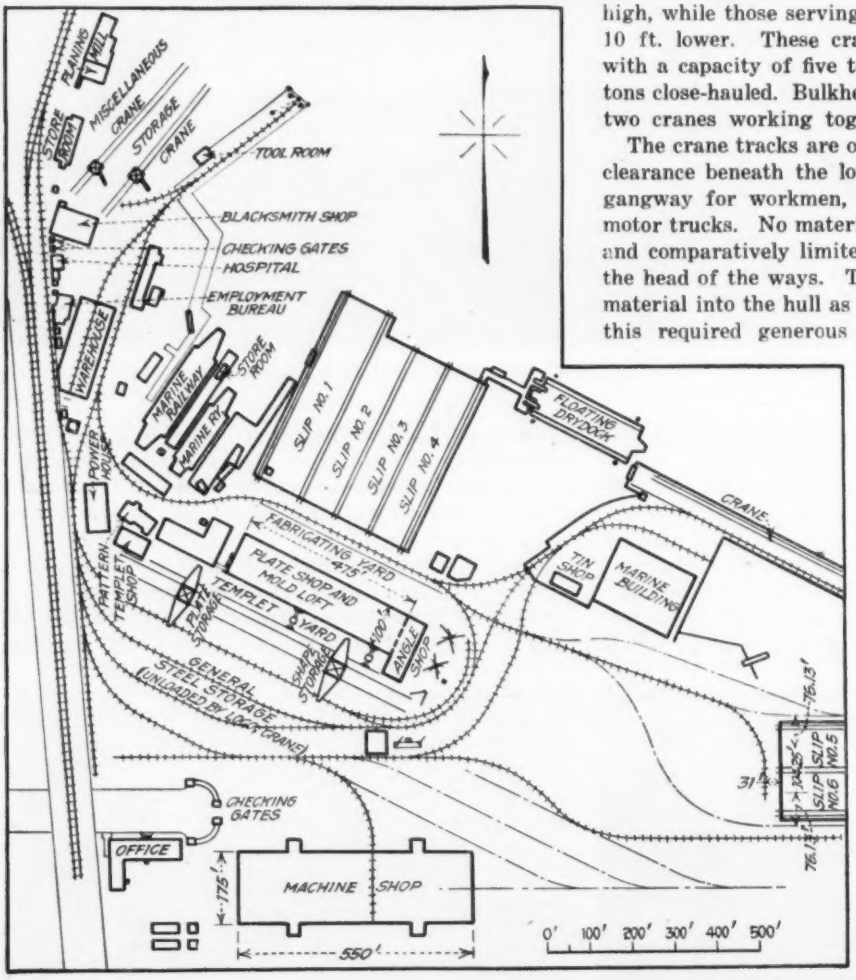


FIG. 6. TWO NEW SHIPBUILDING WAYS AT ALAMEDA FORM A SEPARATE GROUP FROM FOUR OLD ONES, AND HAVE MORE AMPLE ERECTION CRANE EQUIPMENT

high, while those serving the after part of the boat are 10 ft. lower. These cranes have 50- to 55-ft. booms with a capacity of five tons at maximum radius, or 20 tons close-hauled. Bulkhead sections are often placed by two cranes working together.

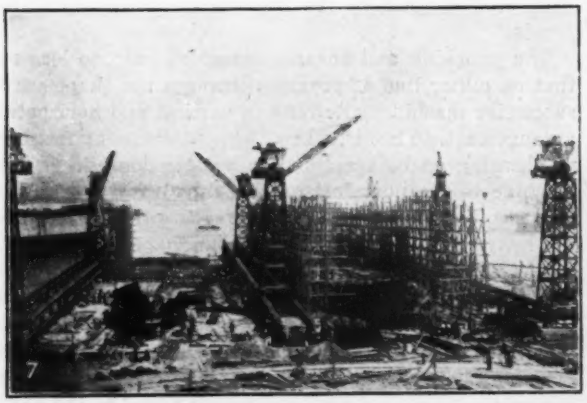
The crane tracks are on steel trestles, so that an 8-ft. clearance beneath the lowest member is provided as a gangway for workmen, or for the operation of small motor trucks. No material is stored alongside the ways and comparatively limited storage space is available at the head of the ways. The plan, rather, is to move the material into the hull as soon as it is ready. Of course, this required generous allotments of equipment and labor, and both these conditions were met. The number of men employed at the yard is about 8000; deducting those not employed on work incidental to ship construction, the actual number of men per way is about eight hundred.

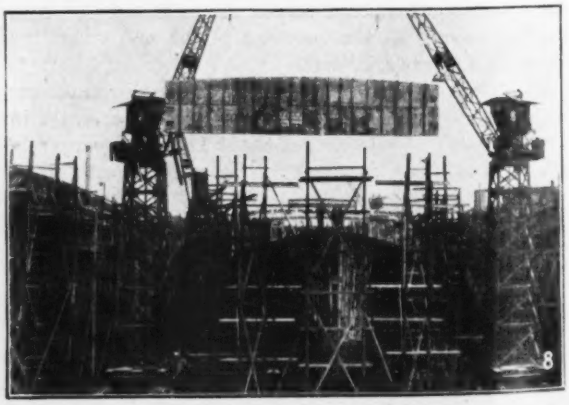
The assembly yard occupies a space 85 ft. wide, extending the full length of the plate shop, and directly in front of it. An 85-ft. gantry crane moves material from one part of this area to another, while finished material is removed by the shipbuilding cranes along the ways. Locomotive cranes can also take material to or from this yard, using the track along the head of the ways.

The ways are wholly of timber construction. Piles are 2 ft. on centers in bents 5 ft. apart under the keel, while the launching ways are supported on a double row of piling. At other points on the ways there is just sufficient piling to support the ordinary deck floor load. The yard is planked wherever the access of tractors might expedite the handling of materials.

two cranes each were put on the inner and the outer tracks, giving six cranes for the two ways.

At the new ways the pile foundation for the cranes were cut off below low water and capped with concrete, the concrete being carried up above the high-water level. The cranes at the forward end of the ways are 60 ft.





FIGS. 7 AND 8. ROTATING JIB CRANES ON TOWERS SERVE ALAMEDA BERTH—NEW WAYS HAVE THREE TURRET CRANES EACH; TWO CRANES SOMETIMES COMBINE ON BULKHEAD SECTIONS AND OTHER HEAVY PIECES

Filling the Allies' Rush Order for Airplane Spruce

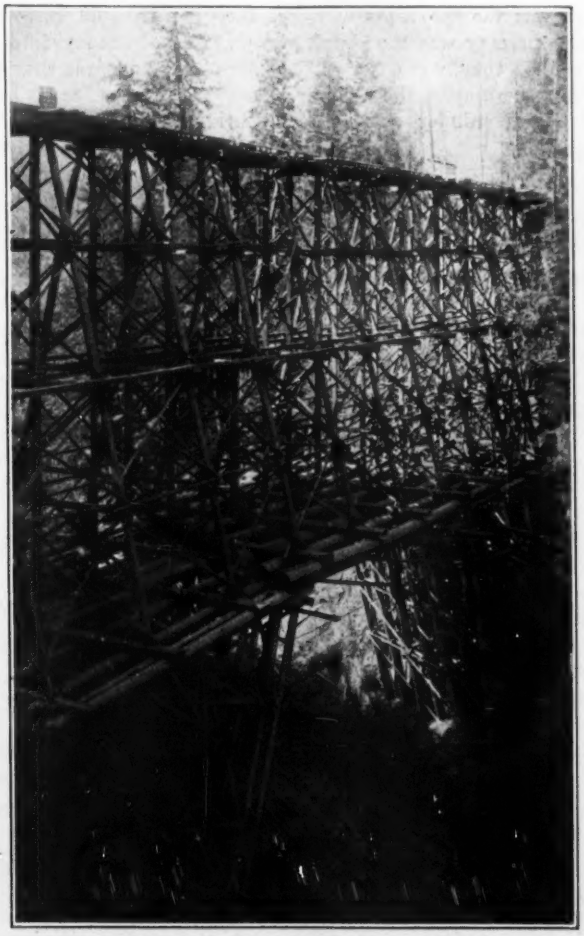
Best Talent of the Country Assembled to Develop Methods New to Logging and Sawmill Practice—Thirteen Railroads Built and 100,000 Workers Coördinated

By Nathan A. Bowers
Pacific Coast Editor, Engineering News-Record

This article was prepared early in November, before the conclusion of the armistice. It is published as written, however, because it is important that the remarkable development of the Government's Spruce Production Division should receive adequate record—Editor.

IN THE forests of the Northwest an army is working at high pressure, directed by the unique combination of a military organization operating on a modern business basis. The Spruce Production Division of the United States Army Bureau of Aircraft Production it is called. It was formed just a year ago, and since then has developed new methods and built up a completely equipped organization for producing daily 30 to 40 carloads of 98% perfect airplane spruce. This output means that the mill built this year at Vancouver, Wash., especially for this purpose has to cut 16,000,000 ft. of airplane stock per month. That is, this amount represents the present net result. The work is still being expanded, and a new goal of 30,000,000 ft. of airplane stock per month was recently announced. There is much of interest to the engineer in this phase of our war program, because new ways and means had to be developed in several fields. In most of these the engineer played an important rôle. The results desired could not have been attained simply by increasing the production of spruce by the old methods, and on a rush schedule the lumber industry, naturally, did not think they could be attained at all. But the work was not put in the hands of the lumbermen; it was turned over to Brig. Gen. Price P. Disque, then lieutenant colonel in the Signal Corps.

He had no experience with lumber, but had made a report on the prospects for getting spruce in large quantities from the Northwest and getting it quickly. He believed it could be done by new methods.



POLE BRIDGE, 196 FEET HIGH, OVER SKAGIT RIVER

So in October, 1917, General Disque began to assemble an organization with which to produce airplane spruce at a high rate. Woodsmen of the Northwest were in an ugly mood; I. W. W. organizers were active and strikes were frequent. But General Disque arbitrated the differences between employers and woodsmen, put the entire industry on an 8-hour day basis and organized the Loyal Legion of Loggers and Lumbermen to prevent the spread of seditious propaganda. The organization now has more than 110,000 members. Contractors working on a cost-plus basis are furnished with soldier labor, drawn from the national Army. Many came from the timber districts of Michigan and Wisconsin, and the force was strengthened continually, until it now includes some 30,000 enlisted men and 1200 officers. The officers get only their regulation pay but the men receive the prevailing civilian scale of wages. About 75,000 civilians are engaged in the spruce program. In each district where logging or construction work is under way there is, as commanding officer, a representative of the chief of staff. He assigns the soldiers, audits accounts and reports on progress. A district superintendent representing the Government—usually a civilian—actually lays out and directs the work. These two work out their local problems, referring important matters only to headquarters.

The problem of finding the spruce and getting out the logs came first. The heaviest stands were discovered on a strip of territory about 50 miles wide on the western

slope of the Coast Range in Oregon and Washington, the wildest and most inaccessible section of the West. There were practically no transportation facilities in the region, because the fir timber, heretofore the chief lumber product, grows on the eastern slope.

Cruisers' reports were collected, and supplemented where necessary, and locating engineers were sent out to make cost estimates of the railroads needed to tap the best timber. Where estimates showed a railroad cost of less than $3 per 1000 ft. of spruce tapped, construction was approved. Thirteen separate railroads, as shown in the table below, were thus decided upon.

This railroad construction would take time. Meanwhile, spruce was urgently needed. General Disque therefore made contracts with lumbermen for the delivery of all the clear spruce they could get, and in addition sent his own crews to supplement the supply. Over the protests of lumbermen he inaugurated selective logging methods—the felling of only those trees which had been picked by experts as suitable for airplane stock. Where the stand was too sparse to warrant roadbuilding, or where the country was too rough to get out the logs in the round, they were "rived" where they fell—that is, the logs were split, the knotty heartwood was removed and the remainder was split up into "flitches" of convenient size.

Government Selective Plan Superior

How the commercial methods compared with the Government's selective logging plan appears from the fact that logs from commercial logging camps contain only about 25% of airplane stock, while the logs taken from trees selected under the Government's methods average about 80% airplane stock. At present the cut for Government use is about 16,000,000 ft., log scale, per month, of which 75% comes from commercial and 25% from Government camps. By next spring, when the new railroads are operating, these conditions are to be reversed, so that three-quarters will be Government cut and one-quarter commercial. By that time the monthly total will probably reach 30,000,000 ft. of airplane stock.

Selective logging was not the only new departure General Disque insisted upon. Logs could be sawed, he maintained, to get a much higher percentage of clear, straight lumber than the usual methods afforded. To prove this he produced his own expert and designed a Government mill to be built at Vancouver, Wash. Lumber men declared the mill could not be built in less than a year and then might not be a success. Again their arguments were disproved. Early this year the mill went up in 45 working days, and instead of the 25% of airplane stock produced by ordinary methods from clear "flitches," the mill is producing 65%. Three other mills are being constructed in logging centers from which sawed cants [wide, thick boards in the rough] will be sent to the Vancouver mill. Their capacities will total 1,300,000 ft. per day.

The Vancouver mill is designed for quality, not for quantity, despite the fact that it is the largest in the world. The most important departure from standard methods is at the head saws, where the logs get their first cut. Here each log is considered separately and is handled to get out the maximum amount of straight-grained stock, regardless of the number of cuts required. When being put on the head-saw carriage the logs are blocked out in alignment with the saw to get an equal cut from end to end running straight with the grain. The log is turned frequently during the sawing and cants about 2⅜ in. thick are cut from successive faces.

Logs less than 60 in. in diameter are sawed with the exact taper of the log, into 2⅜-in. cants, full width, until some defect appears; then the log is turned on the carriage and another face is begun. This is continued thus until all the clear material is in cants. Chains are used for turning the logs, in place of the usual "niggers," whose spurs would scar the faces in the frequent turning.

By this method broad, flat cants are secured with faces parallel to the grain. An inspector tests the grain with a blunt needle, and with a crayon indicates on each cant the direction of the grain. The mark is used to align the cant on the carriage so the saw will cut parallel to it, regardless of the angle which the cut makes with the edge of the cant. Thus, the pieces which come through the second cutting have both edge and flat grain parallel to the faces. This method has made it possible to use cants from logs that had a slight twist, and increases from 6 to 18% the airplane stock that can be made from a clear "flitch." A variation from straight grain of 1 in. in 20 is allowed by the airplane-stock specifications.

Use of Model Saves Many Beams

The mill proper now covers about 5 acres and has 12 head saws. Extension of plant and improvement of methods are being made continually. For example, roller feed and loading dogs for the carriages on one pair of head saws has increased the capacity there 38%. When this improvement can be made throughout, it is expected

RAILROADS BUILT TO REACH SPRUCE STANDS

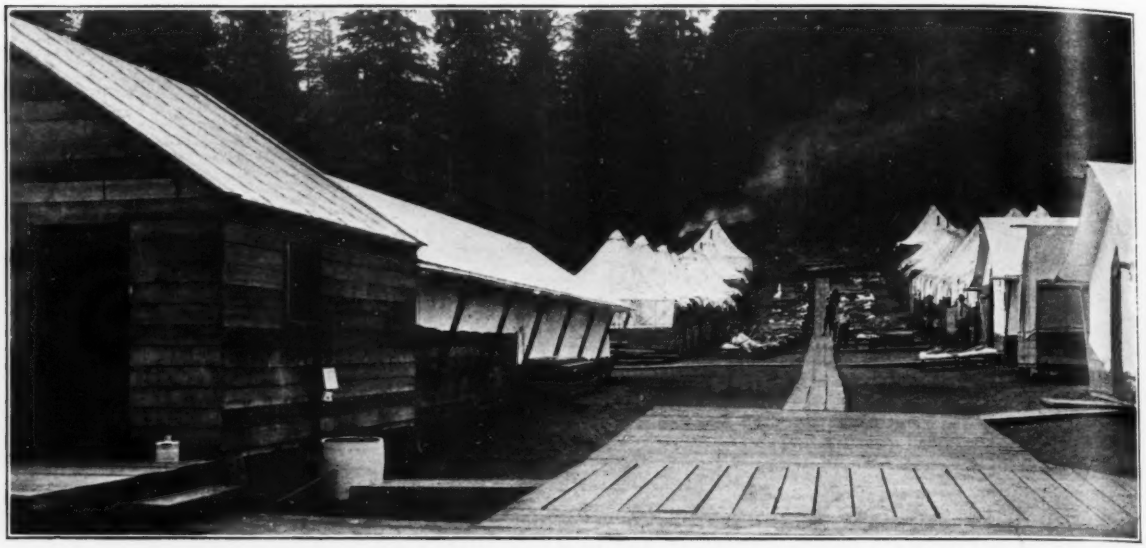
No.	Name	Location	Main Line, Miles	Branch Lines, Miles	Total Spruce Available Feet
1	Lake Crescent Line	Joyce to Lake Pleasant, Clallam County, Washington	36	8	1,250,000,000
2	Merrill & Ring Line	Northwest from Pysh, Clallam County, Washington	5	1	39,000,000
3	Quinault Line	Quinault River Valley, Grays Harbor County, Washington	13	3	125,800,000
4	Elk River Line	Grays Harbor County, Washington	6	5	50,000,000
5	North Nemah Line	North Nemah River, Pacific County, Washington	10	5	60,000,000
6	South Nemah Line	Middle Nemah to South Nemah River	7	3	33,000,000
7	*Nasel Line	Near Nasel, Pacific County, Washinton	3	..	10,000,000
8	*Lewis and Clark Narrow Gage Line	Lewis and Clark River, Clatsop County, Washington	4	..	.....
9	Lewis and Clark Line	Lewis and Clark River, Clatsop County, Washington	22	12	131,000,000
10	Toledo and Siletz Line	Near Toledo, Lincoln County, Oregon	3	3	17,000,000
11	Yaquina Northern	North from Yaquina Bay, Lincoln County, Oregon	27	14	160,000,000
12	Yaquina Southern	South from Yaquina Bay, Lincoln County, Oregon	24	12	300,000,000
13	Beaver Hill Line	Near Coos Bay, Coos Bay County, Oregon	7	7	170,000,000
	Totals		167	149	2,345,000,000

*Narrow-gage.

These Views Show Operations Through Which Spruce Production Was Raised in One Year to 30,000,000 Feet Per Month

RIVING A LARGE LOG SO THAT IT CAN BE HAULED OUT BY MOTOR TRUCK

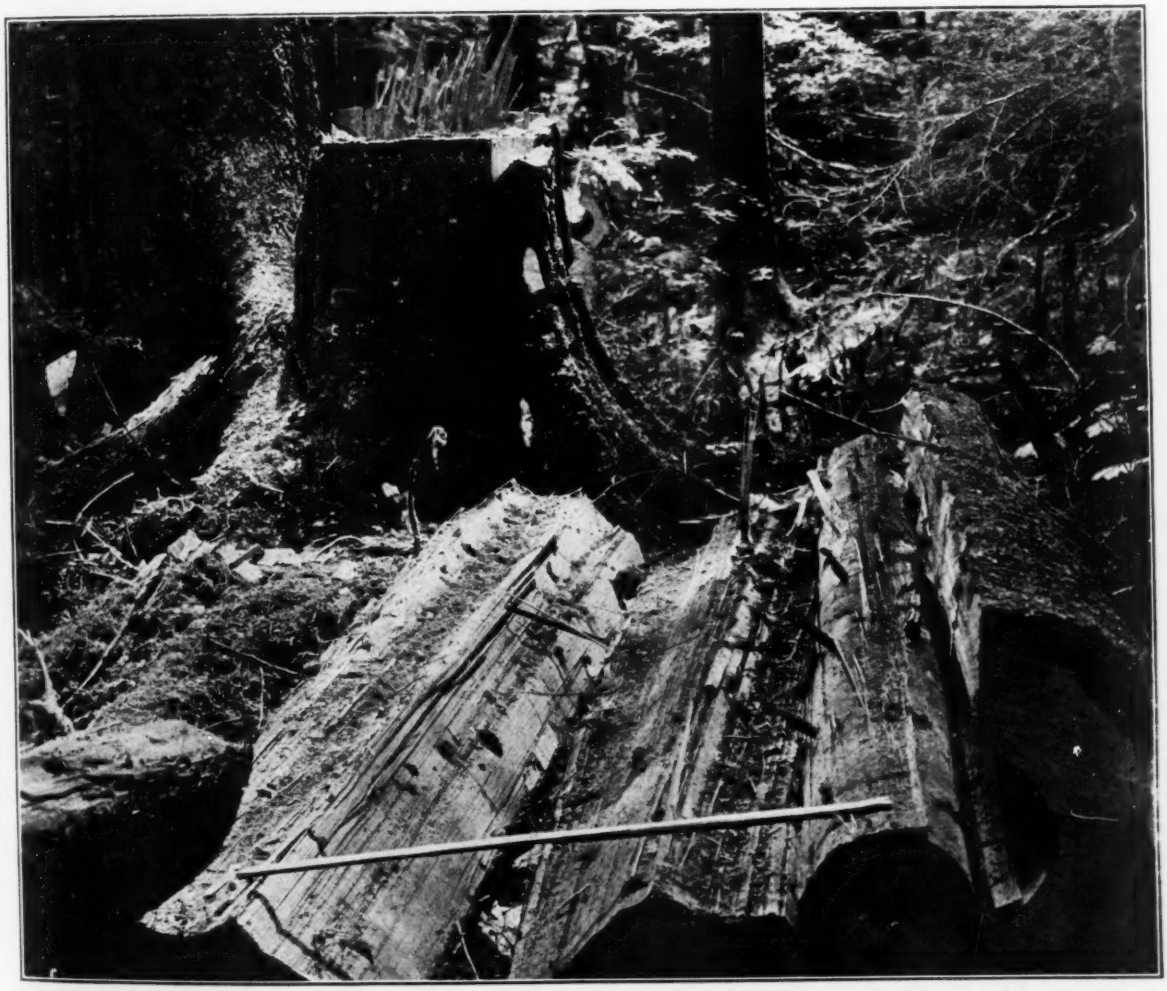
ROADS ARE LOCATED AND GRADED WITH GREAT CARE—A CORDUROY ROAD IS SHOWN AT THE LEFT



CAMPS ARE MAINTAINED ON STRICT STANDARDS OF MILITARY SANITATION

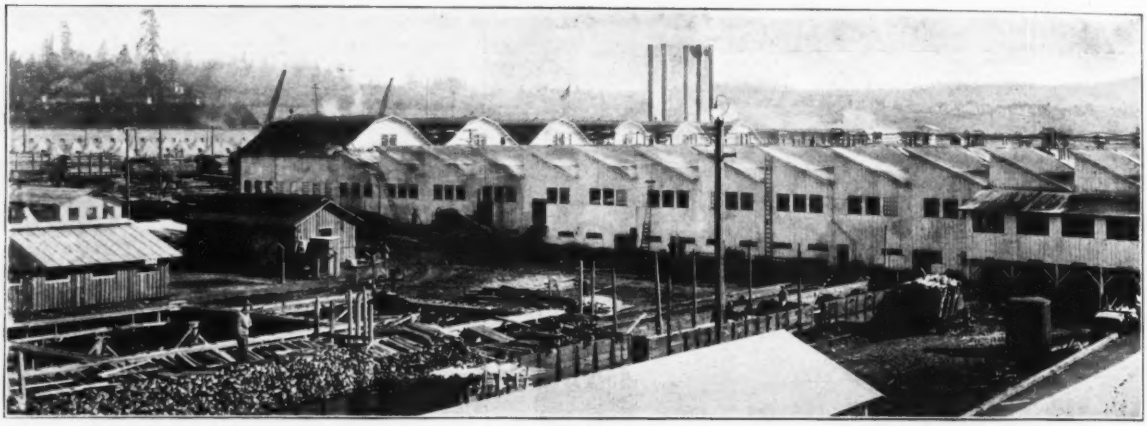
ROUGH COUNTRY NECESSITATES FREQUENT HIGH TRESTLES FOR SPRUCE RAILROADS

TRAINLOAD OF CLEAR SPRUCE LOGS—NO FASTENINGS REQUIRED ON THESE CARS

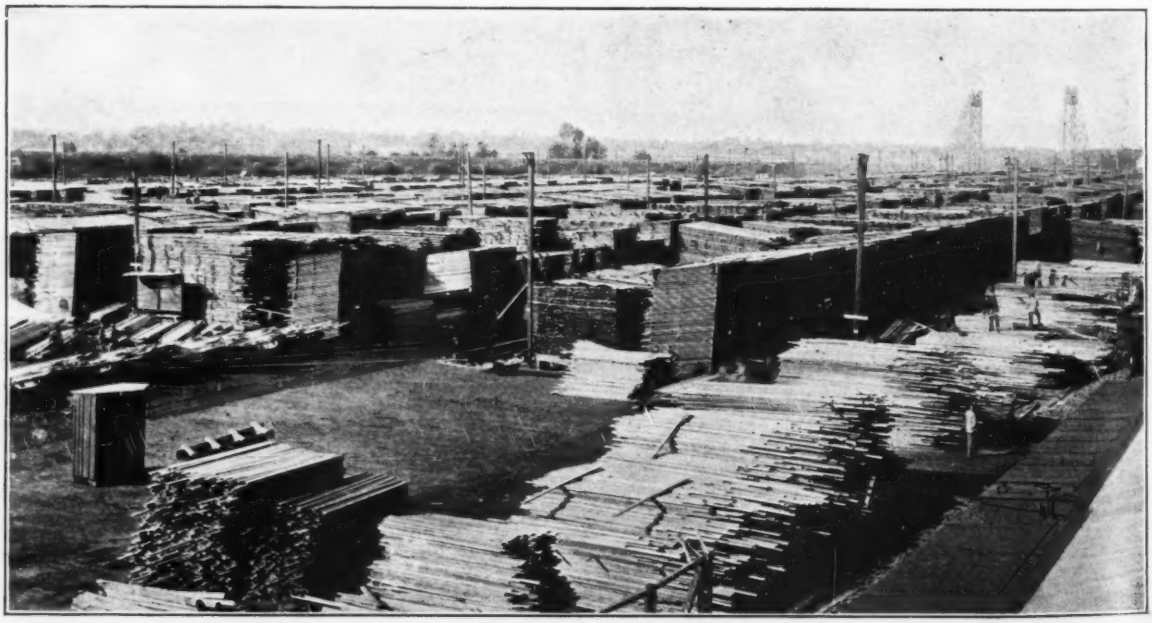


CLEAR FLITCHES ARE SEPARATED FROM KNOTTY HEARTWOOD, WHICH IS DISCARDED

BEING LESS AFFECTED BY HEAVY RAINS, TIMBER CRIBBING IS OFTEN USED INSTEAD OF FILLS



VANCOUVER MILL WHICH NOW CUTS 16,000,000 FEET OF AIRPLANE STOCK PER MONTH



COMMERCIAL STOCK, A BYPRODUCT IN SECURING AIRPLANE SPRUCE, ACCUMULATED AT FIRST, BUT A MARKET FOR IT HAS BEEN DEVELOPED WHICH IS NOW EQUAL TO PRODUCTION

that the daily cut will increase by 500,000 ft. The use of a completely finished wing beam as a model saved, the first day it was used, 268 wing beams that would otherwise have been culled because of slight defects. The finished beam has tapered ends and hollowed sides, and defects at these points would be cut out, in any event, in the final trimming.

By extra reworking of material, the wastage is kept very low. In a cant with two or three defects two extra cuts are made to get each defect on a narrow piece, thus saving whole the pieces of standard size. These are some of the features that make possible the high percentage of perfect stock. At first, plans of wings, as constructed at various factories, were not filed at Vancouver. Therefore, many pieces unnecessarily long or just too short for wing beams were shipped. Since blueprints have been obtained as guides for cutting and shipping, the number of beams culled at the factories has dropped to two per cent.

It has not been practicable to cut to exact sizes of parts required by the allies, so spruce is shipped overseas in the largest cross-sections that can be secured clear. Dimensions of some of those being loaded for shipment when data for this article were collected were 8 x 20 in. by 20 ft., and 10 x 15½ in. by 25 ft.—clean, straight-grained sticks of perfect spruce. Of course the 40-ft. length of the box cars puts a limit on the longest pieces that can be shipped. No open cars are used for airplane stock, and small cross strips are placed between layers so that the wood can season while en route.

The fire risk at the mill was great, of course, and no safety precautions could be neglected. Yet the expenditure of $95,000 which a sprinkler system would have cost was believed unwarranted. The mill fairly teems with men (all of them soldiers) at every hour of the day and night, all trained to military discipline, and the best protection was considered a complete fire patrol force, with adequate fire mains. Fire guards are on duty continually, principally on roof beats, and it is only necessary to sound the alarm to call the 4000 men at the plant to their fire stations.

Railroad Construction Rapid

Railroad building in connection with the spruce production program has involved some of the most difficult location and most rapid construction on record. Decision on most of the lines was made in the spring, and some 10,000 enlisted men have since been employed on the work. Construction forces were put in the field as close behind the location parties as feasible, and most of the lines will be completed before the rains set in.

Many miles of pack trails and truck roads were built to open up the work at as many points as possible. Some of the camps were entirely under canvas, others had framed mess-houses and barracks. Each one constituted a military unit, in charge of a commanding officer and a construction superintendent. All the sanitary measures of a regular Army camp were put into effect.

Standard gage was used where the lines have a permanent value, and where the construction could serve only in the present emergency narrow gage was ordered. The construction standards followed were planned for the purpose of carrying heavy logging traffic continuously in territory where the annual rainfall is from 100 to 180 in. concentrated between the months of November and May. Grades have been limited to 2% except in special cases, and the curvature kept below 6 degrees.

Great care has been taken to provide ample drainage where heavy cuts or fills were required, and all track is heavily ballasted. In some places beach sand 1 ft. deep is put on fills before the ballast. Some of the spurs are built entirely on logs 36 to 60 in. in diameter and 70 to 100 ft. long. These stringers, into which the ties are notched, are supported on cross logs or heavy timber cribs, the whole structure being put together with the use of donkey engines.

This construction was used frequently in the heavy timber. It did away with the need for clearing and grubbing, which often amounts to $10,000 per mile. Another type of construction used to save the cost and delay of clearing was the three-pile bent trestles with sawed caps and stringers. If rock prevented the driving of piles, cribs of 30- to 60-in. fir and hemlock logs were built up instead, all the work being done with logging equipment.

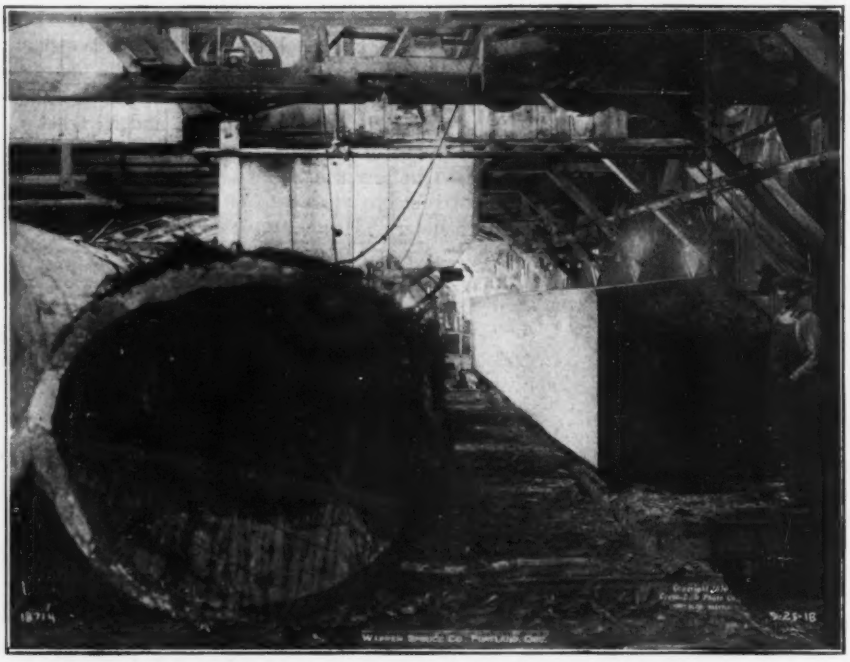
Water Delivery Without Wharfage

Many bridges were required on the lines along the coast. Some were 80 to 90 ft. high and of considerable length. On this work delivery by water, without wharfage facilities, was developed to a high degree. At first the coast guards in surf boats took charge of rafts as they were cast loose by the tugs, but after a more thorough knowledge of tidal currents was developed rafts of bridge timbers were regularly cast adrift, as far as three miles at sea, and came to the desired points on the beach without attendance. From the beaches motor trucks took the material over plank roads to its destination.

Some of the bridges illustrate the conditions and methods that often prevailed. The Alsea bridge is an 8800-ft. trestle, for which 6000 piles were cut nearby and driven with a piledriver built at the site. In another bridge 105-ft. piles were used, and are in service with a 75-ft. cut-off—this is said to be the record for height of unframed structures. Where power equipment could not be provided quickly, the lack was made up by manpower. In one case it was found to be time economy to make a cut 100 ft. deep with pick and shovel.

The operation of these railroads, newly constructed lines in a region of excessive rainfall and under very heavy traffic, will be the business of the department of railway operation recently added to the organization. The lines will not be common carriers. On railroad No. 1, 30 geared engines will be used to assemble log trains on the main line, and through trains will be handled by 15 Mikado consolidated locomotives. The latter are expected to make 125 engine-miles per day, the traffic on the entire line amounting to about 1400 train-miles per day.

The cost of getting out logs depends upon the location and density of the stand. The best spruce is on the Olympic peninsula, where in some sections 47% of the forest is spruce. But this is unusual. In the average stand tapped by the new railroads only about 17% of the trees are spruce. So-called good stands range from 10,000 to 40,000 ft. per acre, and a tree is cut for its airplane stock if it contains one straight-grained log 20 ft. long.



SAWING UP A HUGE LOG OF CLEAR NORTHWEST SPRUCE

Where timber cruisers make a favorable report, tree spotters are sent out to locate and number each spruce tree and estimate the footage of airplane stock it contains. On maps drawn to a scale of 10 in. to a mile the spotters mark the location and number of each tree, and fill in such topography as the loggers will need. Thus the plan for handling each log is worked out before the equipment goes into the woods.

Some Over-All Cost Figures

Where riving camps have been operated by cost-plus contractors, a check on the over-all cost has shown the average to be $105 per 1000 ft., while on the most expensive operation the cost was $114.97. Independent operators are being paid $130 per 1000 ft., but the need for lumber from this source will disappear as the Government railroads begin to deliver from the stands which they tap.

The railroads, mills and all equipment of the Spruce Production Division are being amortized on a 10-month basis, so that the entire cost of the emergency measures may be included in the rate as now quoted. Even on this basis the present cost of producing airplane stock is only $180 per 1000 ft. The allies are charged at the cost rate. Previously they paid as much as $300 for clear spruce, much of which was not useful, of course, because it was not sawed parallel to the grain.

Developing Market for Clear Spruce

The 35% of the Vancouver mill cut which is commercial stock (i. e., not suitable for use in airplanes) steadily accumulated, until it was apparent that some plan of disposal would have to be found. This meant developing a market for clear spruce, a problem that was put in the hands of a sales department organized in July. The department faced a threefold problem: (1) To clear the accumulation of commercial stock at the Vancouver mill; (2) to salvage a byproduct that would otherwise waste, and (3) to develop markets that would not encroach on or conflict with the sales channels already developed. In fact, unless the general situation in the entire Northwest field had been relieved, the production of airplane spruce would have suffered. Private mills could turn only about 25% of their cut into airplane stock, so they accumulated 3 ft. of commercial stock for every foot sold to the Government. Seven men experienced in marketing Western lumber in Eastern fields were sought out, and one was put in each of seven Eastern centers. These men have found in old fields new uses for the exceptionally clear spruce lumber; they develop new fields where they can, such as in foreign and Government factories and in lines where spruce has not been previously exploited. Their work is the more difficult because 80% of the stock is less than 6 in. wide, and the thickness ranges from $\frac{7}{8}$ to 4 in., varying by sixteenths.

Despite the fact that Eastern markets did not know Western spruce, and in the face of a shorter haul on Southern pine, the new department developed in three months a business equal to the output of commercial lumber at the plant (about 400,000 ft. per day), and had on file orders for 12,000,000 ft. of the 20,000,000 ft. of accumulated commercial stock. This was done with prices kept on a par with current rates.

Although the Northwest is supplying 75% of the Government ship timbers and airplane stock, it gets only 10% of the Government orders for commercial stock. It is pointed out that relief from this situation is urgently needed, and that the mills cannot long continue operation under this unbalanced condition. The importance of the objection to hauling back empty cars is recognized, but the producers face the all-important problem of a continually increasing accumulation of commercial stock produced as an incidental to the special war orders.

Production Corporation Authorized

The United States Spruce Production Corporation has recently been established by Congress as a war-time business department of the Government, similar to the Emergency Fleet Corporation. The spruce corporation, capitalized at $10,000,000, will carry on as a general manufacturing business the work started by the Spruce Production Division. As principal stockholder, the Government backs the enterprise, and General Disque continues to direct the work as president of the corporation.

Touching on only the chief features of General Disque's professional record, it may be said that he entered the regular Army in 1899, and was advanced from

sergeant to first lieutenant in the Philippines. In 1913 he was a cavalry captain on the Mexican border; later, returning to the Philippines, he was assigned to construction work until 1917. Then he resigned to accept the position of warden at the Michigan State penitentiary, one of the few self-sustaining prisons in the country. After a notably successful administration there, when this country entered the war he applied for his old commission as cavalry captain. Instead he was made lieutenant colonel in the Signal Corps, and last October was sent to the Pacific Coast to report on the spruce situation.

When the executive staff for the Spruce Production Division was being organized the aim was to find the ablest men available on the continent. Lumbering as General Disque proposed to do it would be a new business, and exceptional talent was necessary. For department heads, particularly, he sought men of experience who had breadth and initiative. Such men were found, and for the win-the-war work they accepted the pay of a captain or a major, although in doing so the department heads have sacrificed an average of $10,000 per year.

The enterprise and enthusiasm which these men have put into their work has set a high standard in one of the great undertakings of the war, and General Disque credits his staff with a large measure of the year's success.

Compressing Concrete Increases Its Strength

Plain Columns of Successive Layers Pressed Down Average Half Again as Strong as Those Poured for Full Length

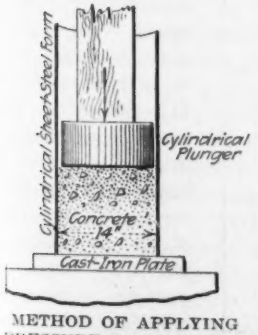
BY FRANK P. MCKIBBEN

Professor of Civil Engineering, Lehigh University, Bethlehem, Penn.

DENSITY in concrete being an acknowledged aid to strength, an effort was made in some recent tests to determine whether this desired density can be obtained by compressing the concrete during deposition. While it is admitted that there may be difficulties in applying the process to construction, the fact that the tests show that strength can be materially increased by successive compressing of layers may lead to further investigation.

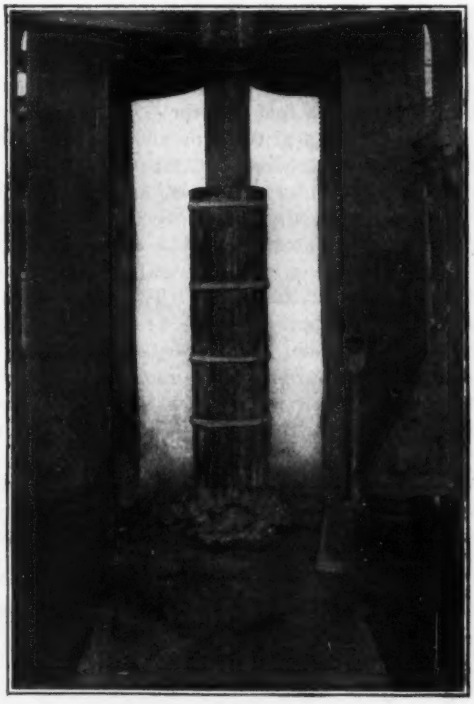
The records herewith given cover two types of columns: First, "ordinary concrete" columns, made of 1:2:4 concrete in the usual way, of which five specimens were tested, and, second, "compressed concrete" columns made of identically similar 1:2:4 concrete but compressed during the process of molding, the compressive loads varying from 25,000 to 40,000 lb.—that is, from approximately 160 to 260 lb. per square inch of cross-section. Ten of these compressed concrete columns were tested, eight at the age of 28 days and two at the age of 56 days.

All columns were approximately 5 ft. long and 14 in. in diameter, and no reinforcement whatever was used in any of them. The concrete used in both the ordinary and in the compressed columns was of uniform quality, proportioned in accordance with Taylor and Thompson's tables of quantities for a 1:2:4 mixture. The fine aggregate was Delaware River sand, a material too fine for good results, but commonly used until recently in the Lehigh Valley. The large aggregate was extremely hard, crushed limestone of excellent quality, practically all of which pasesd a 1½-in. mesh, the dust being screened out. The molds used were of sheet steel rolled into cylindrical form, care being taken to prevent the loss of water by making the forms tight.



METHOD OF APPLYING PRESSURE TO CONCRETE

The ordinary concrete columns were molded by spading concrete into the forms and tamping with an iron bar. Each compressed concrete column was molded in five layers, each layer being about 12 in. deep, and as each was placed in the form a pressure was applied to the upper surface of the concrete by means of a plunger. The pressure was allowed to remain on each successive layer for a few minutes, the plunger being then withdrawn; more concrete was spaded into the form, this in turn being compressed. Thus, the process of placing about 12 in. of concrete into the form and compressing the same was repeated five times to complete each column approximately 5 ft. in length. The plunger used in compressing the wet concrete was 13 in. in diameter, and the nominal inside diameter of the form



FORM IN WHICH CONCRETE WAS COMPACTED

The forms were stripped three days after the columns were molded, the column then being kept in wet canvas for four days. During the rest of the 28 or 56 days, in the two cases, respectively, the columns were exposed to the air of the laboratory.

The columns were tested in the Lehigh University 800,000-lb. vertical screw machine in a standard manner. Longitudinal and lateral deformations were measured.

Tables I and II give the main data of the tests. It is interesting to compare the weight of 147 lb. per cubic foot for the ordinary concrete columns with the average of 153 lb. per cubic foot for the compressed concrete columns, a difference of 6 lb., or about 4 per cent.

TABLE I. TABULAR VIEW OF ORDINARY CONCRETE COLUMNS
— At Time of Testing —

Column Number	Water Per Cent.*	Wt. of Column, Pounds	Wt. of Column, Lb. Cu.Ft.	Age in Days	Length, Feet	Diameter, In.	Ultimate Compressive Strength, Lb. per Sq.In.
P-1	8.6	...	...	28	5.0	14.56	2,390
P-2	7.9	...	...	28	5.0	14.34	2,420
P-3	8.0	851	147	28	5.0	14.58	1,640
P-4	...	888	147	28	5.02	14.81	1,240
P-6	8.0	815	147	28	5.0	14.25	1,180
Average,	8.1		147				1,774

* Ratio of water to cement plus sand plus stone.

The compressed concrete columns failed more suddenly than the ordinary columns, and whereas in an ordinary concrete column failure occurs by crushing or by shearing on inclined planes the compressed column splits longitudinally on a diametrical section for a considerable portion of its length. The compressed concrete contains perceptibly fewer air spaces than does the ordinary concrete. Moreover, although the limestone was of very hard quality, practically all stones on the fractured section were pulled in two. Seldom in compressed concrete did stones pull out of the mortar.

The advantage of compacting the concrete is clearly shown by the high ultimate strength of the compressed concrete. For 28-day ordinary columns the average compressive strength is 1774 lb. per square inch, as compared with 2680 lb. per square inch for compressed concrete, a gain of 906 lb. per square inch, or 51%. Contrast this 51% increase in strength with the 4% increase in weight. It is quite evident that compacting is very effective.

Now refer to Table III, wherein compressed concrete columns are grouped with the compacting load as a basis. It is here revealed that a molding compression of 25,000 lb. produced an ultimate strength of 2255 lb. per square inch; a molding compression of 30,000 lb. produced an average ultimate strength of 2540 lb. per square inch; 35,000 lb. pressure gave an average of 2780 lb. per square inch for the three columns, C-9, C-12 and C-15. Observe that with the compacting load of 40,000 lb. for column C-15, the resulting compressive strength was 3550 lb. per square inch, a value almost exactly double the average of the five ordinary concrete columns.

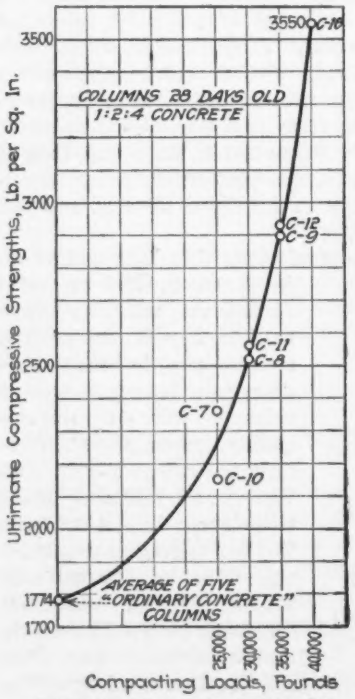
TABLE II. TABULAR VIEW OF COMPRESSED CONCRETE COLUMNS
—At Time of Testing—

Column Number	Water, Per Cent.	Load Used to Compact Columns, Lb.	Aver. No. of In. Column Compacted at Each Application	Wt. of Column, Lb.	Wt. of Column, Lb. Cu.Ft.	Age in Days	Length, Ft.	Diameter, In.	Ultimate Compressive Strength, Lb. per Sq.In.
C-7	8.6	25,000	1¼	808	150	28	5.00	14.06	2,360
C-8	9.2	30,000	1	754	149	28	4.67	14.09	2,520
C-9	8.2	35,000	1	732	150	28	4.56	14.05	2,900
C-10	8.9	25,000	1⅛	733	149	28	4.60	14.00	2,150
C-11	7.8	30,000	1⅛	751	152	28	4.58	14.07	2,560
C-12	6.8	35,000	0⅞	765	155	28	4.61	13.99	2,930
C-15	6.8	35,000	0⅞	773	158	28	4.67	13.88	2,500
C-16	6.8	40,000	0⅞	775	153	28	4.67	14.10	3,550
Average									2,680
C-13	6.5	25,000	0⅞	763	155	56	4.60	14.00	3,590
C-14	6.0	30,000	0⅞	790	154	56	4.79	14.00	4,940
Average	7.6				153				4,265

TABLE III. COMPARISON BETWEEN ULTIMATE UNIT STRENGTHS AND LOADS USED IN COMPACTING COMPRESSED CONCRETE COLUMNS

Column Number	Age in Days	Compacting Pressure, Pounds	Ultimate Compressive Strength, Lb. per Square Inch
C-7	28	25,000	2,360
C-10	28	25,000	2,150
Average			2,255
C-8	28	30,000	2,520
C-11	28	30,000	2,560
Average			2,540
C-9	28	35,000	2,900
C-12	28	35,000	2,930
C-15	28	35,000	2,500
Average			2,780
C-16	28	40,000	3,550
C-13	56	25,000	3,590
C-14	56	30,000	4,940

For C-14, age 56 days, the ultimate compressive strength is 4940 lb. per square inch, nearly three times the strength of ordinary concrete at the age of 28 days. Of course, the element of time enters into this high compressive strength for C-14. The accompanying diagram illustrates even more strikingly than does Table III the effect of compacting the concrete. A careful study made by the writer shows that stress deformation curves for the compressed concrete columns are much more nearly straight than the corresponding curves for the or-



EFFECT OF COMPACTING ON STRENGTH OF CONCRETE

dinary concrete columns, many of the curves for the former being fairly straight almost to the ultimate strength.

Moduli of elasticity corresponding to unit compressive stresses of 500 lb. per square inch are shown in Table IV.

Additional tests on compressed concrete should be made to determine the proper amount of water to be used in mixing, the maximum intensity of load permissible during molding and the effect of using compressed concrete in spirally reinforced columns. It seems certain that up to some point not yet determined increased ultimate strength follows with increased loads for molding, but beyond that critical point the excessive pressure may remove so much water as to leave insufficient for proper hydration of the cement.

TABLE IV. MODULI OF ELASTICITY OF COMPRESSED CONCRETE COLUMNS FOR UNIT COMPRESSIVE STRESSES OF 500 POUNDS PER SQUARE INCH *

Column Number	Modulus of Elasticity Lb. per Sq.In.
C-7	3,555,000
C-8	4,083,000
C-9	3,480,000
C-10	3,405,000
C-11	3,506,000
C-12	5,647,000
C-15	5,743,000
C-16	4,788,000
Average	4,276,000
C-13	3,474,000
C-14	3,606,000

* When tested, all columns were 28 days old, except C-13 and C-14, which were 56 days old.

Assistant Professor M. O. Fuller of Lehigh University and former students W. A. Stickel, C. W. Tanner, P. M. Teeple and C. R. Uhl deserve all credit for making these tests.

Buffalo Water-Waste Survey Saves Water, Coal and Labor

Pitometer, House-to-House Inspection and Fixture Repairs Produce Remarkable Results, With City Only Half Covered

By George C. Andrews
Water Commissioner, Buffalo, N. Y.

WATER consumption and waste in Buffalo reached 339 gal. per capita for the year which ended June 30, 1917, based on a total pumpage of 61,471,000,000 gal. No systematic effort to reduce waste had been made for a number of years, with the result that, while ample pumpage capacity was available and an unlimited supply obtainable from Lake Erie, the increased consumption had overtaxed the mains. There was a consequent decreased pressure in the outlying sections. The prejudice against meters and the absurdly low rate of 2c. per 1000 gal. (since raised to 4c.) precluded the universal use of meters, and it was decided to make a thorough water-waste survey of the entire city. The results, with the survey only partly completed, have been notable as regards the saving of both water and coal.

The city was divided into ten sections. The Pitometer Co. of New York was engaged to survey one of these sections and then, if the results justified taking such a step, was to be engaged to survey the entire city. Work was started in June, 1917, and in September, 1917, the final report on section 1 was submitted. The results to be obtained were so evident from the start that surveys were ordered in two additional sections while work on the first section was in progress, and the balance of the survey was ordered in January, 1918.

The first section surveyed was divided into seven districts. The water was measured in each district by the pitometer method of isolating the district and measuring the consumption for 48 hours, and then comparing the minimum night rate with the total consumption. Where metered industries were in the district their consumption was read during the test period, and the readings corrected accordingly. At first, subdivisions were made at night of each block in the district, with the idea of locating underground leaks, but the house waste was so great and so constant in practically every district that this was abandoned until after a thorough house inspection had been made. In conjunction with the pitometer engineers 20 of the regular inspectors of the Water Department were employed. These men worked in pairs. They first made an inspection for house waste. Then, by shutting off the house cock, they tested by aquaphone for a leak in the service between the house and the curb box; and also, by shutting off the water at the curb, for a leak in the service between the main and the curb box. Blanks were prepared and a report was required on the conditions found at each house. At all places where faulty fixtures were found and services were in poor condition, a "notice to repair" was served. This notice stated the nature of the trouble and called for repairs in 24 hours, under threat of having the water shut off.

Each "notice to repair" was attached to a stub which was retained by the inspector. Approximately a week later a reinspection was made of the buildings where a "notice to repair" had been served, and if the repairs had not been made the water was turned off. In the first section surveyed this was not rigidly enforced, but practically 75% of the leaks were repaired at once. Where places were metered no inspection was made. All unmetered business places were served with a notice that a meter would be installed.

Waste Caused by Antifreezing Closets

A considerable number of antifreezing closets were found in this section. At first meter notices were served, but the department felt that it was not advisable to meter these places at that time and a special notice was printed calling attention to the waste of water by that type of closet and to the fact that it was almost impossible to keep it in repair. Notice was served that if the closets were not kept in repair meters would be installed. This notice resulted in the changing of a number of such closets to those of the tank style.

A considerable number of complaints came to the office at first from persons who had employed plumbers to make repairs; these plumbers had failed to appreciate the seriousness of small leaks and had unwittingly slighted their work. But these complaints became fewer as the work progressed and the plumbers did better work.

The results obtained in section 1 were, briefly, as follows:

Total consumption in 24 hours before survey, gal.	12,345,000
Total consumption in 24 hours, after survey, gal.	8,337,000
Reduction, gal.	4,008,000
Percentage of reduction	32
Number of underground leaks	12
Leakage per 24 hours from underground leaks, gal.	887,000
Number of services in section	8,000
Number of defective services found and ordered repaired	308
Percentage	3.9
Number of dwellings in section	7,889
Number of fixture leaks	3,449
Percentage of fixture leaks to dwellings	43.7

Section 2 comprised old, low-grade dwellings, mostly equipped with antifreezing or evasive closets. The total consumption in this section was 19,051,000 gal. per day, with a minimum night rate of 83.3%. Repairs ordered in this section were made much more promptly than in section 1, notwithstanding the fact that, as a class, the property owners were poorer. Unfortunately, an early winter accompanied by a heavy snow prevented a remeasurement of this section until spring. At that time, notwithstanding the fact that more than 6510 leaky fixtures and 431 service leaks had been repaired, no material reduction in consumption resulted. This is a section where selective metering must be employed, as repairs to antifreezing toilets are not permanent. The department has now raised the rate on this type of closet from $1.50 to $10 per year, and a large number have been taken out. Meters have been installed on several services supplying such closets, and the results are astounding. One place showed a consumption of more than 4000 cu.ft. per day, yet the owners still asserted that there was no waste. Considering the number of people living in this district, the consumption should not be more than 10,000,000 gal. per day, at the most liberal estimate.

Section 3 was a sparsely settled part of the city in which pipes had been laid twenty-five years ago, anticipating a quick development which is now just arriving. Most of the mains were laid in the sewer trench to avoid excavating rock, as the rock in this section is within 2 or 3 ft. of the surface. At the time of paving the streets service connections were made for all lots, with the result that hundreds of unused supplies had been in the ground for twenty-five years. As the services and the mains are in the sewer trenches, leaks are seldom indicated by water appearing on the surface. The total consumption in this district was 7,291,800 gal. per day, and the minimum night rate was 77.2%. A large number of broken, unfinished supplies and several cracked pipes were discovered by pitometer measurements, which alone accounted for a total of 2,805,000 gal. per day in this section. The number of leaky fixtures was practically in the same ratio as in section 1. Service leaks were in a slightly larger ratio.

The survey is now practically 50% completed, and the pumpage each month is showing a cumulative decrease as compared with the preceding year, as may be seen from the following:

PUMPAGE, IN MILLION GALLONS

Month	1917	1918	Decrease
June	4,560	4,527	33
July	4,835	4,676	159
August	5,092	4,666	426
September	4,611	4,118	493
October	4,614	4,069	545

The actual reduction in waste is much greater than indicated, as the industrial use of water, as shown by meters, is more than 10% greater than last year.

The reduction in pumpage has resulted in the saving of nearly 1000 tons of coal per month, and practically a 25% reduction in labor force at the stations.

The permanency of the work is shown by remeasurements in section 1, just one year after the work was completed, when practically no increase in the night rate of consumption was found.

Promising Results with Miles Acid Process of Sewage Treatment in New Haven Tests

Good Removal of Suspended and Settleable Solids and Bacteria—Effluent and Sludge Stable—Grease Utilization Problems—Local Conditions Favor Process at New Haven

EXPERIMENTS with the Miles acid process of sewage treatment at New Haven, Conn., indicate that although the process seems to have some rather serious limitations which might preclude its use elsewhere, yet it promises to be satisfactory for the conditions which prevail at New Haven. The following statements regarding the experiments and the results obtained are from a paper by Prof. C.-E. A. Winslow, professor of public health, Yale University, and F. W. Mohlman, chemist of the Connecticut Department of Health, read before the annual convention of the American Public Health Association last September.

The most extensive investigations of this process, so far conducted, have been carried out by the writers at New Haven, Conn., during 1917 and 1918. Conditions here seemed *a priori* unusually favorable to the process of acid treatment. It was desirable that the effluent to be produced should be clarified and disinfected but not necessarily nitrified—precisely the results which the Miles process aims to produce; and the sewage was known to be of low alkalinity on account of the presence of acid industrial wastes.

The experiments were conducted under an appropriation made by the City of New Haven, and directed by a committee of which the senior author was chairman and of which Prof. S. E. Barney and A. B. Hill were the engineering members, and with the junior author as chemist in charge of the plant.

The studies were made at two of the five different outfall sewers of the City of New Haven. Four different runs were made with the East St. sewage and one run with the Boulevard sewage, each run ranging from 24 to 75 days. In each case small wood tanks were used, the average detention period being four hours. The acid was applied in the form of SO_2 gas. The alkalinity of the East St. sewage is very low (averaging

only 50 p.p.m. for the four runs), so that it was necessary to add only 700 lb. of acid per 1,000,000 gal. of sewage treated, to secure an acidity of 50 p.p.m. (as calcium carbonate). At the Boulevard sewer 1130 lb. of acid per 1,000,000 gal. of sewage were required to secure an acidity of 50 p.p.m. (as calcium carbonate).

General Results of Miles Acid Treatment

The general results of the acid treatment were highly satisfactory. The removal of total suspended solids amounted to 61 and 66%, respectively, at the two outfalls, and the removal of settleable solids to 90 per cent.

The sewage of the East St. sewer is an abnormal one, having a very low bacterial count as a result of the presence of copper salts contributed by industrial wastes. During the first run at East St. an insufficient amount of acid was added, and the treated effluent had an average acidity of only 12 p.p.m. Yet even in this case the removal of total bacteria averaged 85% and of B. coli types 98%. The removal of total bacteria averaged 87% in the second run, 98% in the third, and over 99% in the fourth run and in the Boulevard test. The removal of gas-forming organisms was 89% in the third run and over 98% in all other cases. Of all samples of effluent examined at East St. 91% showed less than 10,000 bacteria, and 84% less than 1000 B. coli per cubic centimeter, while at the Boulevard 91% showed less than 10,000 bacteria and 41% less than 1000 B. coli per cubic centimeter.

Both Effluent and Sludge Stable

It is particularly important, from the point of view of the practical sewage-works operator, to note that both effluent and sludge were so affected by the acid present as to be stable for considerable periods, so that with a plant of this type no local nuisance need be anticipated. During the whole period of our experiments there were only one or two occasions on which slight signs of septic action were noticed in the tank, and the sludge was stored in barrels for weeks without the production of offensive odors.

From Aug. 17 to Sept. 27, 1917, we operated the Miles acid tank as a plain sedimentation tank, using the same quantity of sewage and the same procedure in all respects, except that the addition of acid was omitted. Only 40% of the suspended solids was removed from the sewage, as compared with 60% by the Miles acid process. Septic conditions were pronounced in the tank, as the increase in ammonia nitrogen and alkalinity indicate. Bacterial determinations were not made during this test, but there is no reason to suppose that the count decreased to an appreciable extent, particularly in view of the offensive condition of the sludge. The sludge was higher in moisture content than was the Miles sludge, and much less sludge and grease was recovered. This was partly due to the low suspended solids in the raw sewage, but even if there had been 105 parts, as in the acid tests, instead of 88, the sludge and grease recovered would have been, respectively, 360 and 70 lb. These quantities are 75% and 58% of the quantities recovered by the acid process.

The information obtained in regard to the amount and general character of Miles acid sludge is presented in the accompanying table:

CHARACTER OF MILES ACID SLUDGE AT NEW HAVEN

	East St. Sewer				Boulevard Sewer
Length of run	25 days	24 days	44 days	70 days	29 days
Total gallons sewage treated	260,000	239,400	407,820	602,220	145,500
Gallons wet sludge per m.g. sewage	3,750	4,025	3,200	2,600	5,375
Specific gravity	1,067	1,048	1,054	1,061	
Per cent. moisture	86.6	88	86.3	85.7	92.5
Pounds dry sludge per m.g. sewage	503	483	439	368	403
Ether extract, per cent. dry sludge	23.7	24.0	29	32.6	30.9
Ether extract, pounds per m.g	119	116	127	120	124
Volatile matter, per cent. dry sludge	47.2	51.2	57.3	63.8	78.5
Nitrogen, per cent. dry sludge	1.6	1.6	2.4	2.0	3.0

So far the results of the New Haven experiments were very favorable to the Miles process; but when the grease which had been recovered was studied with more care, in order to determine its real commercial value, the aspect of the matter began to change. The difficulty lies primarily in the presence of a large proportion of unsaponifiable material (waxes, mineral oils and similar substances) in the ether extract, substances of this kind being practically worthless and their presence necessitating costly processes of purification. The sludge obtained in the third, 44-day run when analyzed by Dr. Raymond Wells yielded 24% of grease, 46% of tankage and 28% of water. The grease analyzed as follows: Moisture and volatile matter, 11; unsaponifiable material, 21.1; free fatty acids (by weight), 40.2; neutral grease, 22.3; insoluble and metallic soap, 3.3; of the 40.2% of free fatty acids 14.4% was rosin and 25.8% actual free fatty acids. The degreased sludge contained 3.91% of nitrogen as NH_3, 0.96% of phosphoric acid as P_2O_5 and 51.88 % of ash. The grease obtained from the other three runs made with the East St. sewage contained, respectively, 19.8, 20.7 and 28.3% of unsaponifiable material.

Study of Unsaponifiable Material

In view of the fact that the East St. sewer receives contributions of mineral oil from a munition factory it was thought that the large amount of unsaponifiable material might be due to this cause, and the Boulevard plant was installed to test this point with a fairly normal domestic sewage. The result here was distinctly better, the proportion of unsaponifiable material being only 15.7% with 41.5% free fatty acids, 0.5% moisture and volatile matter and 1.3% insoluble impurities. Even this value is still so high as to impair seriously the value of the grease.

It seems probable that a fairly high content of unsaponifiable material is a normal characteristic of grease obtained from sewage sludge. Thorpe in his "Dictionary of Chemistry" says: "Sewage fats are characterized by large proportions of free fatty acids. The amount of unsaponifiable matter is also considerable. The nature of this has not yet been investigated. Probably it consists to a large extent of coprosterol which forms an important constituent of excrementitious matter." Lewkowitsch, in "The Technology and Analysis of Oils, Fats and Waxes," notes the presence of 11.6% of unsaponifiable material in the grease obtained at Cassel. The source of this material is apparently the feces themselves, for a review of the literature shows that of the ether extract of dried feces (which amounts to 27—35%) 12—14% is unsaponifiable matter, about half of the latter perhaps being cholesterol.

The usual limit for unsaponifiable matter in grease

to be used for soap making is about 5%, and unless grease containing 10—20% of material of this kind could be economically distilled it could be used only as wool grease, which is worth about half as much as garbage grease, or 5 to 6c. a pound, according to the high prices of 1918. Samples of the sludge obtained from New Haven sewage were submitted to Colgate & Co. and the Cobwell Corporation of New York and to Swift & Co. and Armour & Co. of Chicago, and the chemists of all of these concerns, after extracting the grease and studying it, were of the opinion that in its crude state the material was of practically no value to the soapmaker. If such grease is to be utilized it must first be freed from its impurities by distillation.

P. F. Wild, vice-president of the Falk Co., grease distillers, Pittsburgh, arranged to distill a 4-lb. sample of the grease obtained from the Boulevard sewage. The material was saponified and then decomposed, and the fatty acids obtained were distilled. The product which resulted was light brown in color but had a noticeable odor, although the chemist of the Falk Co. reported that it was much less offensive than garbage grease. He added that the grease can be worked in practical manner if the sulphurous fumes which are in combination with the oil can be removed. Otherwise, during distillation this considerable sulphurous acid involved is more or less destructive to the apparatus used, and imparts a rather disagreeable odor during the distillation.

The distilled grease thus obtained amounted to 70% of the crude grease, which yielded in addition 3% of glycerine and 22% of pitch.

According to the estimate of William M. Ware & Co., Boston, the crude product as obtained from the sewage should be worth 8.5c. a pound, and the grease from the East St. sewage (containing 25 instead of 15% of non-saponifiable matter) not worth more than 6.5c. The ether extracts obtained from both sewages varied between 116 and 124 lb. per 1,000,000 gal., but the extractions made for us by the Cobwell Co. and the Colgate Co. indicate that not more than 100 lb. could be safely assumed on a commercial scale in either case. On this basis the Boulevard grease would be worth perhaps $8.50 per 1,000,000 gal. The grease from tankage corresponding to 100 lb. of grease per 1,000,000 gal. would amount to 300 lb. for the Boulevard sewage. This grease-free tankage contained 4.8% of ammonia worth at $4.00 a unit (20c. a pound) $2.88 per 1,000,000 gal. The Boulevard sewage would therefore yield products worth altogether $11.38 per 1,000,000 gallons.

Grease From East Street Sewage

Our data in regard to the grease obtained from the East St. sewage is less satisfactory, since this material was not distilled on a commercial scale. Dr. W. S. Richardson, of Swift & Co., and Dr. Paul Rudnick, of Armour & Co., believed the crude product to be practically unsalable. Dr. M. H. Ittner, of Colgate & Co., found 20% of unsaponifiable material in his sample and emphasized the fact that the grease would have to be distilled and would probably yield less than 60% of fatty acids. G. A. Molleson, of Kuh & Valk, grease brokers, New York City, considered the grease as submitted to him to be unsalable and suggested that if the total of moisture, volatile matter and unsaponifiable matter could be brought below 20% it might be worth 5 to 6c. Dr. Raymond Wells of the Cobwell Corporation thought that even for use as wool grease distillation would be necessary, and that some of the mineral oils present in this sample might possibly go over in the distillate, making even the distilled product unsuitable for soapmaking. He thought 5 to 6c. a pound would be as much as the grease was worth. He noted also that the composition of the sludge was such as to threaten certain difficulties in extraction if the process were not carefully controlled. Dr. Rudnick had the same experience, reporting clogging in the separation of the finely divided sludge from the gasoline extract.

Altogether, in view of the peculiarly unfavorable characteristics of this particular sludge, we do not believe it would be safe to assume a value for the crude product of more than 5c. per pound. This estimate, however, we feel is not too high, in view of the possibility of distilling the grease and its suitability for wool grease if not for soapmaking. This would amount to a return of $5 per 1,000,000 gallons.

The East St. sewage should yield 350 lb. of tankage per 1,000,000 gal., but its tankage contains only 3% of ammonia, giving a tankage value of $2.09 per 1,000,000 gal., which, with a grease value of $5, would give a total return of $7.09.

Applicability and Cost of the Miles Acid Process

Based on the production of SO_2 gas by burning sulphur (assumed to cost $36 a long ton) and on drying from 85 to 10% moisture (coal assumed at $7.50 per ton) it appears that the acid treatment of the sewage from the East St. outlet should be materially cheaper than either Imhoff treatment or fine screening, under existing local conditions. With a fall in the price of grease after the war the outlook would be less favorable.

Cost estimates for the treatment of the Boulevard sewage are of a somewhat different character. The Miles process is here considerably more expensive—first, because of the higher alkalinity of the sewage, and second, because of the fact that the plant would be smaller and costs per unit volume therefore larger. If the problem of the Boulevard sewer stood by itself we should be somewhat in doubt whether to favor Imhoff or acid treatment, with the facts in hand. Since, however, the case for acid treatment seems so clear for the East St. sewer we are of the opinion that it would be wise to delay construction at other New Haven outfalls until the acid process has been tried out on a practical scale at the point where it promises best results.

Our experience with New Haven sewage lends no color to the hope that a net financial profit can be obtained by the use of the Miles acid process, except with sewage of exceptionally high grease content and low alkalinity. They do, however, suggest that for communities where clarification and disinfection are desirable —where screening would be insufficient and nitrification unnecessary—the process of acid treatment comes fairly into competition with other forms of tank treatment; and that it is particularly suited to dealing with sewages which contain industrial wastes, and to use in localities where local nuisances must be avoided at all costs and where sludge disposal could be provided for only with difficulty.

Great Lakes Yards Lead Coast Districts in Building Ocean-Going Ships

Produce Canal-Size Steamers in Large Numbers—Spirit of Coöperation—Yard Capacity Doubled—Side Launching—No Outside Fabrication—Equipment of Varied Character—Labor Shortage

(Passed by the Publication Approval Committee, Emergency Fleet Corporation)

(Continued from last week)

Additional space economy is realized in a number of yards by using dry docks as launching slips (Buffalo, Lorain, Toledo, Chicago). Water being required only at launching time, the docks between launchings are often occupied by vessels undergoing repairs. Assumption of control over dry docks by the District Manager a year ago assured coördination of the dock use with shipbuilding. This seizure, which had the hearty cooperation of owners and builders, had the object of assuring the least possible disturbance by interference due to repairs and ship reconstruction work. All repair jobs have been allocated to those yards and dry docks where they would cause least dislocation of shipbuilding. Riverside berths are found at Cleveland, where the available low ground is quite narrow; at Manitowoc, where a neck or peninsula is occupied by the shipyard and a series of peripheral berths has been developed; and at the Globe yard in Superior. Simple dock and berth construction is used on the Lakes. Depths of 12 to 15 ft. are required directly alongside the launching face of the berth and a bulkhead is therefore needed. Timber sheetpile construction is universally employed for this. Little other construction or foundation work is required at the berth, except keel-block stringers and some lateral piling or pile-supported bents.

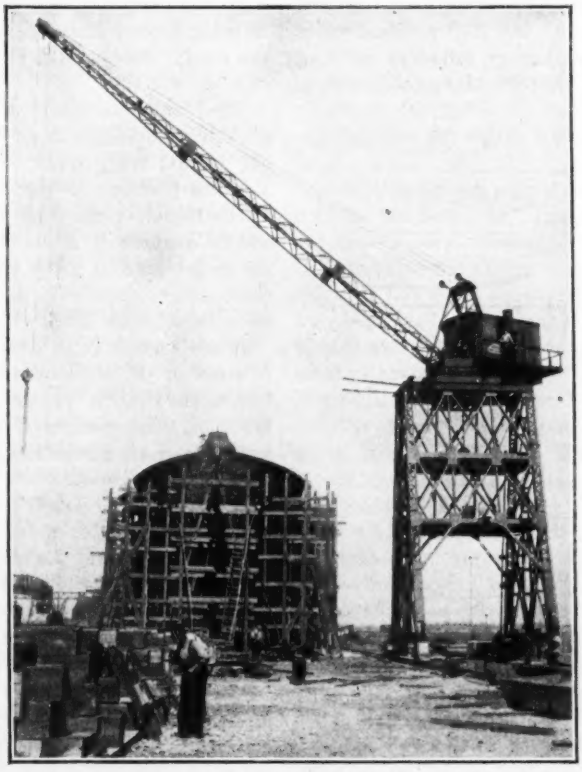


FIG. 5. SHIPBUILDING IN MANY LAKES YARDS HAS BEEN EXTENDED BY LOCOMOTIVE TOWER CRANES

Cranes of various types are in service. The principal cranes of the pre-war period are trolley bridges of two forms: Cantilevers running on tracks alongside the berth and reaching out over the full width of the berth, and gantry cranes straddling the berth. In the past year locomotive cranes mounted on portal or gantry substructures have been installed in many of the yards (Wyandotte, Ecorse, South Chicago, Manitowoc, Duluth) as part of the expansion of crane facilities necessary. These machines (Fig. 5) could be obtained more quickly than cranes of other types.

Many of the yards found during the past year that more crane equipment was desirable for making full speed in the shipbuilding. In the slip-and-pier type of yard the oldest cranes are double cantilever machines, giving one hoist hook for two long berths (Fig. 6). This is the case at the Wyandotte, South Chicago and Superior yards. Most of the others had one crane for each long berth, giving one hook for two of the present short ships. The tendency during the past year has been to provide one crane per short berth, where possible. With arrangements like that shown in Fig. 6 increase of crane service proved difficult or impossible, but careful management succeeded in keeping these berths practically up to the normal rate of production made on other berths in the yard. Other handling equipment of the shipyards has been affected relatively little by the emergency shipbuilding needs. It includes locomotive cranes for general yard transportation and material handling, and shear-legs for placing boilers and engines in the ships. These latter machines (Fig. 7) are universal in the Great Lakes yards. Heights of 100 ft. and capacities of 65 to 100 tons are standard. No changes were required in this service. There has, however, been a general increase in the number of yard-service locomotive cranes, both on account of expansion of the yard track systems and because of increased need for transportation per unit of track.

Handling material direct from punch shop to shipbuilding berths was the prevailing system of yard operation in past years. Generally, little or no storage for fabricated material was provided. The pressure of war-time shipbuilding brought out a need for storage between shop and ship, in order to make fabrication and yard operations reasonably independent. Most yards have therefore set apart storage space and put up

additional plate racks for material ready for erection, in their rearrangement of facilities during the past year.

In the typical yard layout the punch shop is located close to the berths, usually about as indicated in the two sketches on page 980 of last week's issue. Cleveland represents quite precisely the normal arrangement for the riverside type of yard. The Manitowoc yard has its punch shop located somewhat farther back, virtually central to the tongue of land around which the berths are grouped. In the slip-and-pier yards the shop is located just far enough back of the slip-head to allow for one or several railway tracks to pass.

Short distance of transportation from shop to building berths has proved its value as a factor in speed of shipbuilding. This is prominent at Cleveland, where with the shop paralleling the berths the material passing out of the punch shop goes into storage directly under the craneway without intermediate handling, and when wanted is moved across to the ship without waste of effort. However, the slowing-up influence of long transportation from the shop is felt only where there is

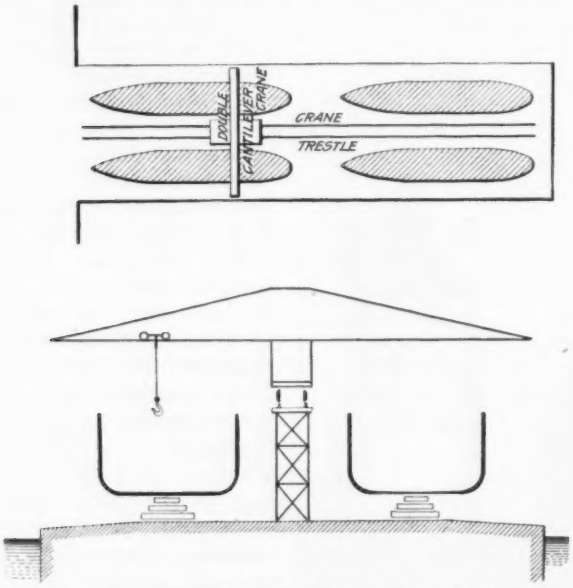


FIG. 6. FOUR BERTHS SERVED BY ONE CRANE HOOK

no storage near the ship; where there is ample storage facility along the building berths, as is the case at Lorain, the long haul from the shop does not appear to cause loss of time but results only in slight increase in transportation expense. In another yard, where conditions locate the fabrication at a distance from the principal berths, delays result because there is no space for fabricated storage at the berths.

Making provision for such storage, and—what is just as important—for assembly of parts that can be riveted up in advance of erection, has been the subject of much careful planning in a number of the yards during the past few months. With the shop located close to the berths, it has sometimes been difficult to find the necessary space for this storage and assembly. The difficulty is pronounced in the pier arrangement of berths with berths grouped on a pier and equipped with a double cantilever crane running on a trestle. Conditions such as are sketched diagrammatically in Fig. 6 usually give no room for supply tracks to the berths, so that much extra crane travel is necessary and storage to serve as take-up between the shop and ship is not easily provided.

A radically new solution of the assembly problem has been brought out by the Wyandotte yard, in the shape of an assembly shop. By allowing the assembly work to be done under cover, and providing a machine riveter for it, this shop is expected to produce a large gain in economy and system of the assembly work. Furthermore, the Wyandotte shop will, it is estimated, increase the riveting capacity of the yard by more than 25 per cent. An assembly shop is also being built at Manitowoc.

Berth layout of such type as to furnish ample space for fabricated storage has proved of very decided advantage, and it was a factor in making possible record-speed shipbuilding at the Ecorse yard. At both Manitowoc and Ecorse the cantilever cranes serving the berths are mounted on wide-span gantry bases, and material is stored and preassembled in the space between the gantry track rails, close to the point of use in the ship.

Yard transportation is taken care of by standard-gage track systems in all the yards. Road-tractor haulage is just being tried out at the McDougall yard. A Fordson tractor was put to work, after the angle cleats on the wheel rims were burned off, and with various special trailers it is counted on for handling much of the miscellaneous yard transportation. If the experiment proves successful, tractor haulage may be adopted on a large scale in this yard.

Crane service is an essential factor in transportation in some of the slip-and-pier yards, where the space between the berths is too narrow to admit of either track or team roadways. All material must be moved from the space at the head of the pier by means of the shipbuilding cranes.

While all other yards in the district are using liners under the out-plates of the shell and tank top, the Ecorse yard of the Great Lakes Engineering Works joggles the frames and floor members. A single joggling press is able to handle all of the work. Some other yards are leaning toward the adoption of the same method. Wyandotte and Manitowoc also have installed frame-joggling machines for future use. Reduction of dead weight of ship and saving in cost are counted on.

The use of reinforced concrete was adopted as a time saver in building a new boiler and engine shop, 80 x 600 ft., at the McDougall yard. The boiler end of the building has been in service for some weeks, and the engine part is just being completed. There is a heavy crane runway in the main or clerestory bay of the building; the crane girders as well as the columns are of reinforced concrete. Steel roof trusses span both main and side bays, forming the only connection between the opposite concrete columns.

Pressed-steel building construction has also been employed in the rush work of yard expansion. At Ecorse a number of store houses for ship fittings have been put up, using pressed-steel frame and sheathing.

Shortage developed in the compressed-air equipment of practically every yard at an early stage of the shipbuilding drive. It was made more acute by the practice of operating many auxiliary machines by compressed

air—in some cases forging hammers, pumps and winches—besides tapping the compressed-air lines for blast connections to the rivet forges. Installation of additional compressors, and often revision of the entire compressed-air layout, due to inability to expand at the old site of the compressor house, was undertaken everywhere by the beginning of 1918. Generally, the increase amounts to virtually a doubling of the capacity originally installed. Ultimate compressor capacities of 1500 to 2000 cu.ft. free air per minute are represented in the installations that are now under way. To help out in their air supply several yards have been working night riveting gangs on the berths, but it has not been easy to carry on this work regularly or efficiently.

Buying compressed air from a neighboring industrial plant was resorted to at Wyandotte to tide over the air shortage. A neighboring industrial plant was able to release a 2000-ft. compressor, in the early spring of the current year, and the yard promptly bought the full capacity of this machine and tied it into its own air line by a pipe connection.

Care of air tools developed as a matter calling for special attention. The stock of air tools has had to be largely increased, and this, with the corresponding increase of the yard forces, necessitated much more careful tool-storage and repair systems. Larger air-tool rooms have been built in most yards, new and more systematic storage arrangements have been provided, and careful provision has been made for daily inspection and repair of the tools.

When war-time shipbuilding activities started, in 1915 and 1916, most of the yards had been shut down for some time, and were working along on repair and docking only, with small forces. The trained yard organizations were largely broken up. Skilled shipyard men were scarce, as the spurt in shipbuilding throughout the country had drained the Lakes district. It became necessary to build up working forces rapidly, in order to handle the urgent orders from abroad. Green men had to be trained for the work. The Manitowoc yard two years ago had less than 200 men, as against a present force of well over 2000; Lorain had only 400 or 500, where it now has about 3200 and is not yet fully manned; the Cleveland yard started work in 1915 with only 12 riveting gangs.

Training men therefore has been—and still is—one of the big problems of the shipbuilding situation on the Lakes. It was made the more serious by steady abstraction of men through recruiting by other districts. "The district has been systematically raided of its shipbuilders by yards elsewhere," said a man fully informed about Lake shipyard affairs.

What has been accomplished by developing new men is instanced by the fact that one yard, for example, has increased its riveting force by some fifty gangs (all made up of green men) and has in the meantime lost to other yards a large additional number. The same yard has developed 40 shipfitters, 27 acetylene burners, half a dozen blacksmiths and furnace men, and a complete punch-shop and bending-slab force.

Dilution was the principal process used in developing men, up to a short time ago. Its success in all instances depended on the teaching ability of the gang bosses and skilled men who had the green hands in charge. The best results were secured where closest attention was given to the problem—that is, where superintendents and foremen personally looked after the training process in detail.

FIG. 7. ENGINES AND BOILERS PLACED IN SHIPS BY SHEAR-LEGS

School training was started at a number of yards within the past year, partly on the initiative of the yards and partly through stimulation from the Industrial Service section of the Emergency Fleet Corporation. It has taken chiefly three forms: First, training the boys and raw men in blueprint reading and in details and terminology of ship construction, by a three or four months' course of night classes; second, training skilled men to act as field instructors; third, training foremen. While this school work is still in its early stages, its value has been demonstrated. The school cannot make skilled workmen, but it can make men quicker to learn certain kinds of work.

At Cleveland, where the evening instruction classes in blueprint reading and ship construction were taken up earliest, and a complete course of print lessons was developed, boys have been made into competent second-class shipfitters in a few months, and laborers who had no prospect of ever rising higher have been made over into dependable second-class skilled workmen. Many yard managers state that the training of skilled men as field instructors has had the result of making the instructors better workmen, besides enabling them to train green hands more rapidly. Considerable expansion of the schooling work is in progress now, under direction of the Emergency Fleet Corporation.

Piecework pay has been applied by all the yards to every item that could be handled in this way, generally all operations except punching, bolting and yard labor. Though the piecework rates are high, full-time work is secured, and often much overtime.

Night work has become the rule for the shops and for material distribution. In connection with the latter, the ship erection cranes are often run at night, distributing material. Ship erection and riveting have been carried on at night only in special cases, for speed. Where air shortage made it necessary to put part of the riveting force on the night shift, as at Wyandotte, difficulty has been found in keeping up this force.

Accommodations for the men are in most cases scarce and far away. The yards at Cleveland, Detroit and Chicago, which are in city districts affording reasonably ample accommodations, have had the freest labor supply. At some of the other yards the situation has been serious enough to require construction of dwellings by the yard or by the Government authorities. At Lorain

FIG. 8. PART OF SHIPBUILDING BERTH UTILIZED FOR PRE-ASSEMBLY

the American Shipbuilding Co. started a cottage development for its workmen, and this was subsequently taken over and expanded to a 250-house operation by the Emergency Fleet Corporation. A similar course of events at Manitowoc resulted in a 100-house development, now under way. The McDougall-Duluth Co. undertook its own housing construction early, and this has continued under the company's ownership and management. Forty houses were built in 1917—they were started even before the yard—and 105 additional ones were erected this year, which, with barracks in the same plot, provides for about 250 workmen.

A dormitory within the yard formed part of the Manitowoc Shipbuilding Co.'s solution of the labor-housing problem. The company equipped the second story of its store house as a bunkhouse. A large lounging and reading room was formed by cutting off one end of the loft, and the remainder of the space was divided up, by 6-ft. partitions of asbestos board on 2 x 4 frames, into rooms 6 x 9 ft. in size, containing each a double-deck steel bunk. The entire space, heated and ventilated by a blower system, has provided satisfactory housing for some 150 men. However, as the space is now needed for other purposes, a special dormitory or barracks building has been incorporated in the Government cottage development nearby, in order to accommodate the men now living in the yard bunkhouse.

A unique restaurant and cafeteria is also a feature of the Manitowoc yard. An old Lake passenger steamer was docked near the bunkhouse, and its main deck fitted up with a boarding section, for the bunkhouse men, a cafeteria section to provide lunches for other employees, and a galley. This is now being replaced by a restaurant of twice the size, fitted up in the old machine shop building near the Government dormitory.

An investment of well over $60,000 in a cafeteria is being made by the Great Lakes Engineering Works at Ecorse for feeding the employees, the distance of the yard from any settled district having made this provision for the workers imperative. At other yards no definite steps have been undertaken to provide boarding facilities.

Supplementing the general spirit of drive and progress in the Great Lakes district, an excellent working spirit appears in most of the individual yards. The fact that riveting averages are high is in itself a demonstration of this fact. The best working spirit, furthermore, is found in the yards which have the highest averages.

How the yard is managed appears to have much to do with its spirit. Where the management makes every effort to keep close to the daily work and close to the interest of the men, the results are good. One yard, which has proved a surprise to the whole district because of its excellent production despite the handicap of old equipment and cramped layout, is distinguished, inside the gates, by the fact that "the superintendent is unusually close to his men"—in close personal attention to training and progress of the men and in requiring that all discharge cases pass through his office and receive his attention, as well as in detail attention to the progress of work. The investigation of all discharge cases gives opportunity for checking up on disagreements between men and gang bosses or foremen, and getting prompt control of disorganizing conditions.

Equally important in its effects is the tying together of the executive staff of a yard by conferences between

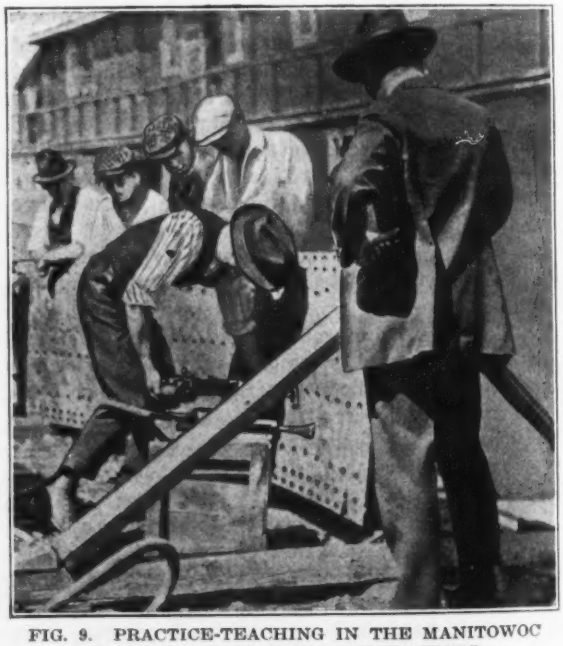


FIG. 9. PRACTICE-TEACHING IN THE MANITOWOC TRAINING COURSE FOR INSTRUCTORS

the superintendent and all his foremen; most yards hold such conferences weekly, and the coördination and drive of their work are in a great measure dependent on the way in which these conferences are conducted. At Duluth group meetings help in centralizing the organization's efforts. The timekeepers of the plant meet on

Tuesday evening, at a dinner furnished by the company. They are privileged to discuss anything in the plant. Matters brought forward by them may, if desired, be taken up at the foremen's meeting, held on Wednesday, with the superintendent as chairman. This is an active meeting, aiming at discovering any impediments to progress in the organization or conditions of the yard. A meeting of yard executives is held in the general manager's office on the following day, to bring out all matters that came up during the week concerning personal elements in the organization. The minutes of the foremen's meeting are read, and where necessary are discussed and acted upon.

A system of noonday music meetings that has been developed—or, rather, that has developed itself—at the South Chicago yard of the American Shipbuilding Co. is said to have been decidedly effective in creating a yard spirit. A band was formed on the initiative of the men themselves, a band leader and a song leader came forward, and in a short time singing mass meetings were organized. These have now become a fixed institution, running three times a week, during the noon hour. Frank La Marche, superintendent, states that they have been a strong influence to hold the men in the yard at noon and arouse their intensely interested participation. They have made the men feel that they belong to the yard and that the yard's interests and work are also theirs—a sound basis for productive efficiency.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Hauling Heavy Girders Through City Streets—A Protest

Sir—In your issue of Oct. 31 there is described the hauling and erection of the large cantilever girders for the Park Avenue viaduct. I had occasion for giving close attention to this remarkable proceeding. While it was in the hands of very competent contractors upon whom no criticism is here intended, the undertaking in its essential features was an outrage, the repetition of which should not be permitted. You briefly mention mishaps and damage which occurred during the work. This is a very important subject, deserving far more attention than you gave it.

The bed of our streets is occupied by a bewildering assortment of electrical conduits, gas, water and steam pipes, sewers, and other substructures. These represent not merely utilities, but the mechanism of life in this community. The usual street traffic is in itself a severe test, but the impact of extraordinary wheel loads cannot be provided against *at all points* because of the variety, irregularity and intermingling of these substructures. Under the common law one may roll the planet Jupiter through the street should he so desire, because it is a public highway. All damage to any substructures resulting from the proceeding can be imposed upon the owner of such property.

For most of their journey through the city streets, six of these girders traversed the tracks of the New York Railways Co. These tracks are maintained by that company at great expense for construction and repair. In design they represent the accumulated experience of many years in many cities. The construction has been approved by the Public Service Commission and all municipal authorities having to do therewith. Its cost has proven too great for most of the cities in the world. The public would never consent to a fare which would pay a return upon the cost of such massive construction as would meet the impact of a 20-ton wheel load. And yet, because our laws provide no restraint, great damage was done to the company's property, no part of which can be recovered by it. Scores of its manhole covers, and in many cases also the frames, were reduced to scrap iron. As the truck wheels bumped over the granite blocks it was evident that the impact was breaking the cast-iron yokes upon which the rails are supported. At many places the trolley slot was closed up and on two occasions the power rails in the conduits were short-circuited. Just how much damage that company suffered only it can tell, but doubtless its track construction in 23rd St. east of Lexington Ave. is practically ruined.

Likewise, numerous sewer manhole covers disappeared from view as the load rolled over them. I am reliably informed that by the time three girders had been moved the entire reserve of manhole covers for sewers and trolley lines had been exhausted. On two occasions the truck wheels crushed the double-plated manhole covers over the splicing chambers pertaining to the underground electrical conduits. In one such case the conductors were short-circuited. Possibly such incidents as one man losing a leg and another having his foot crushed do not pertain to technical discussion.

While the apparent damage to the street paving may not have been impressive, I am convinced from close observation that the concrete base was sheared through at many places. Of course, the destruction wrought by the moving of the first girder was compounded during the journey of its five successors. Surely all of the paving in 23rd St. to Fourth Ave., and in Fourth Ave. to 40th St., will require repairs and replacement at a much earlier date than it otherwise would. No one pretends that street paving is expected to meet such tests.

But beyond the question of material damage is the more important matter of public safety. When 14 double teams of horses are lashed up to dragging an 80-ton load in a city street the possibilities of destruction become very great. Such cavalcades are not easily kept under control. In hauling one of these girders the horses could not be checked in time to prevent the girder crashing in the door of the Metropolitan Bank. While moving another girder, the horses stampeded and dragged the truck against the curbstone on the west side of Fourth Ave. below 32nd St., crushing the curbstone and plowing up the sidewalk; the truck did not stop until the end of the front axle had sunk to the ground. At that moment the forward end of the girder was heading directly toward the windows of the Park Avenue Hotel. The mere circumstance of that building standing back a few feet from the property line to the south averted a disaster. In view of this incident we

may realize how easily a portion of the elevated railroad could have been demolished.

Some engineers, like some statesmen, are prone to exploit their hobbies at the expense of others. In the case under discussion the engineer, his identity being unknown to me, *preferred* to have some girders 136 ft. long and weighing 70-odd tons apiece fabricated complete at Phoenixville and transported thence through the city streets to the place of erection. Apparently the authority over and responsibility for this public improvement was so distributed that no one was in a position to revise this engineer's judgment that there was sufficient justification for hauling a car of Juggernaut through the city streets, doing untold and unknown damage to property, and putting thousands of people in peril of life and limb. Accident and mishap are inseparable from such unusual undertakings. Engineers and contractors must not be free to impose the expense and peril upon the public.

In bridge building many splices and connections of vital importance are riveted in the air. I know of no reason why the viaduct girders should not have been spliced in the field. Surely such a procedure would have cost but a fraction of that incurred in transporting these ponderous girders from Phoenixville to Bayonne, lightering them thence to Manhattan, and then employing a large number of horses and of men at double pay for from 10 to 24 hours per girder. The expense of all of this must have been many thousands of dollars. It is instructive to note here that after one of the large compound girders in the Woolworth Building had been delivered at the site, the remaining ones were cut into three parts at the bridge works.

I am not in the confidence of Terry & Tench, but I will bet my weekly dole of thrift stamps that if they had planned the work the girders would not have been riveted up complete in the shop. Now, as the Park Avenue viaduct is a public improvement, will some one who knows rise in the meeting, and tell us just how much money was saved for the taxpayers by the methods employed?

HERBERT W. ALRICH.

559 W. 164th St., New York City.

Wages of Common Labor vs. Engineers' Salaries

Sir—There seems to be a great deal of attention called lately—and rightly—to the salaries paid to engineers and draftsmen. I am of the opinion that in a majority of cases this class of professional labor is grossly underpaid. We find many firms and municipalities asking for the highest grade of professional training and experience in an applicant, and willing to pay the princely sum of $100 to $125 per month for it.

I noted with interest the article in a recent issue of *Engineering News-Record* by Mr. Newbrough, of Kemmerer, Wyo., which quoted the price of $4 per day paid to his green helpers. I have been unable to get any men at that figure. Our common laborer at the mines draws $4.44 per day of eight hours, and he does just the odd jobs around the outside. In order to get men to help on our surveys we have been obliged to pay the same, or even better wages.

When the wage of unskilled labor amounts to a minimum of $115 per month, how can one help wondering at the low salaries offered for trained professional labor in your "Positions Vacant" columns?

V. S. LAWRENCE,
Resident Engineer, Central Coal & Coke Company.
Rock Springs, Wyo.

What Can Be Done?

Sir—Following the signing of the armistice I lost a position paying $350 a month. I could easily qualify for the position described in the inclosed "want" advertisement in a daily newspaper, but it calls for a combination of a millwright and a mechanical, civil, hydraulic, and designing engineer—at $40 a week, or what a plumber would earn in less than that time.

Cannot something be done to correct such a condition—something that will raise the competent graduate engineer to the plane on which he belongs?

QUESTIONER.

Trigonometric Functions by Slide Rule

Sir—The writer suggests the following simple method for obtaining with the slide rule the cosine of an angle less than 45°, the secant, exsecant and versed sine, and naturally the sine of angles greater than 45°, all with one setting of the slide.

To illustrate, take 15°. Set the slide with indices in line and scale "S" adjoining "A." Set the runner to 15° and read on "A" the natural sine .2588. Transfer this to scale "D" and set 15 on the "T" scale to coincide. The cosine .965 is found on the "D" scale at the right index of "T." This is also the sine of 75°, and .2588 is the cosine of 75°. The secant 1.035 is found on the "C" scale at the left index of "D," or the left recess if the rule is not a duplex. Subtract one for the exsecant. The versed sine is on "D" scale when the cosine is subtracted from one, or can easily be read on the "D" scale.

The above is based on the principle that sine:cosine = tangent:radius, and consequently holds true as long as the sine is not changed. The natural sine as shown on the "A" scale must be set anew each time on the "D" scale, and then the other functions hold true.

Ironton, Ohio. T. S. SMITH.

Wisconsin Road Patrol Is Satisfactory

Road maintenance by the patrol system in Wisconsin has been managed successfully this year, the first season of the new patrol system, according to a report by A. R. Hirst, state highway engineer. Division engineers were required to make specific statements as to maintenance in each county, pointing out where the work done was inadequate and suggesting remedies. Instructions were then given to the county commissioners to remedy the unsatisfactory conditions. Road and bridge construction for 1918 is estimated as follows by Mr. Hirst: Roads graded, 640 miles; crushed stone paving, 110; gravel, 175; concrete, 38; shale, 25; miscellaneous, 15 miles; state-aid road expenditures, $2,400,000; 525 county-aid bridges, $715,196; 127 state-aid bridges, $259,626. The figures exclude Federal-aid work, the greater part of which has been postponed.

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

Reinforced-Concrete House Built Without Forms

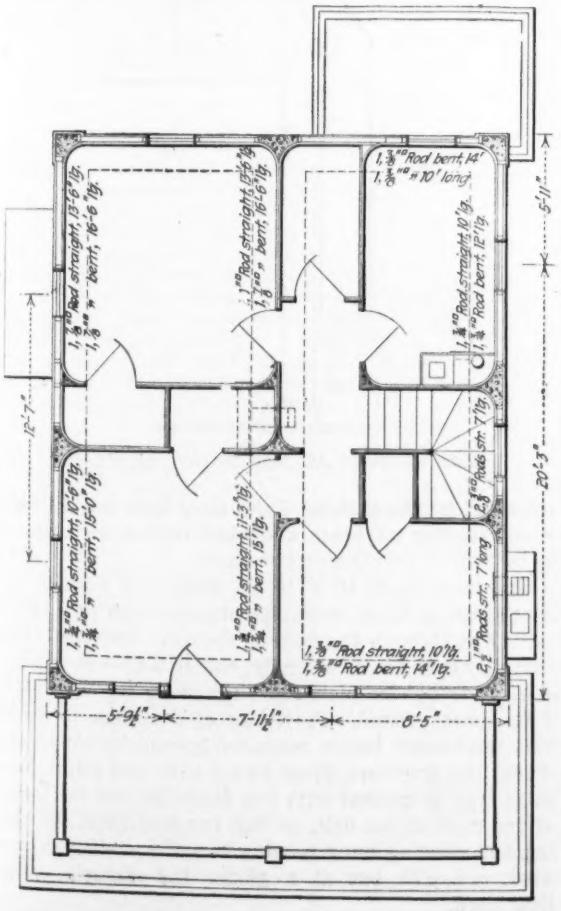
USING metal lath both for forms and reinforcements, a system of concrete construction has been developed which in practice appears to be very effective for small residences. It was devised by C. W. Donaldson and is controlled by the Donaldson Engineering Co. of the Keenan Bldg., Pittsburgh. In the house shown in the views and drawing the costs were about the same as for a similar house of standard wood construction.

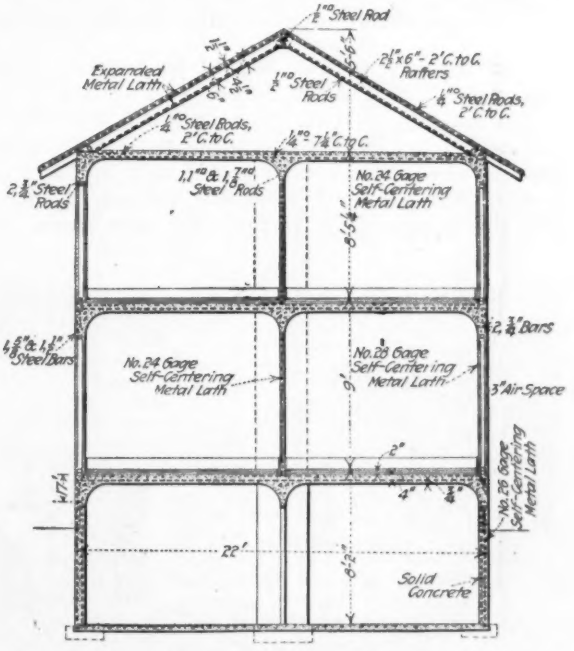
As adapted to house construction, the system comprises a column, beam and girder frame with reinforced-concrete floors and with nonbearing walls and partitions built up by plastering on metal lath. The frame is of concrete poured on the metal lath and plastered outside the lath for finish. The partitions are built as in an ordinary plaster job, and the outside walls are made up of an inner and an outer partition, with an intermediate air space.

A peculiarity of the system is the bending of the metal lath sheets to form the column and beam sections.

LOOKING INTO ROOM BEFORE [illegible]

In the basement, where there are no partitions, the columns are circular, but above the first floor the columns are formed by bending a metal lath for the partition




½"ø Steel Rod
Expanded Metal Lath
2½"x6"- 2'C. to C. Rafters
½"ø Steel Rods
¼"ø Steel Rods, 2'C. to C.
¼"ø Steel Rods, 2'C. to C.
¼"ø 7½"C. to C.
2¾" Steel Rods
1,1"ø & 1,⅞" Steel Rods
No. 24 Gage Self-Centering Metal Lath
4⅝" & 4½" Steel Bars
2, ¾" Bars
No. 24 Gage Self-Centering Metal Lath
No. 28 Gage Self-Centering Metal Lath
3" Air Space
No. 26 Gage Self-Centering Metal Lath
22'
Solid Concrete

ELEVATION AND PLAN OF SMALL RESIDENCE BUILT UNDER DONALDSON SYSTEM

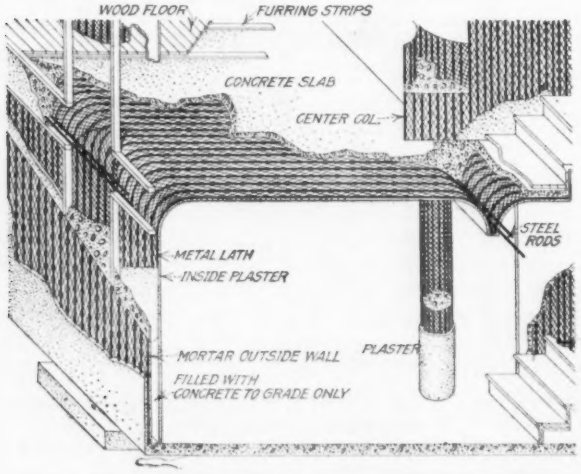
and the inner wall at the corners of the room to form a triangle, inside which concrete is poured to make the column. In similar fashion, the metal lath sheets of the floors are curved down at the ends to form triangles which make the beams.

The construction proceeds exactly as it would in a column, beam and girder building. The metal lath circular forms for the basement columns and the metal

lath for the outside walls are set up for the lower story, and concrete is poured in the columns and plastered on the walls. Metal lath, cut to 30-in. width and bent to the proper curve and length for a single full span, which is about a maximum of 12 ft., are then placed spanning

FINISHED CONCRETE HOUSE BUILT WITHOUT FORMS

the bearing columns and strutted for support. This floor metal is bent at the corners with about a 12-in. radius and secured at its ends. It will hold its shape against the weight of the concrete used to form the floor. The concrete is then poured to a thickness of about 3 to 3½ in. for the floor slab, and running down into the triangle beam to form the beam there. If



DIAGRAMMATIC VIEW OF FORMLESS CONCRETE HOUSE CONSTRUCTION

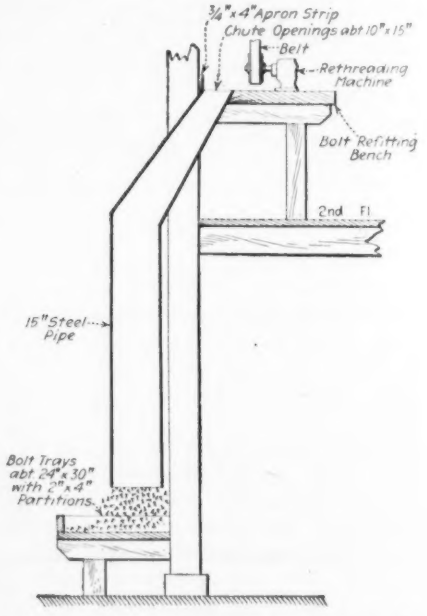
necessary, the beam and the columns can be reinforced by rods in the proper location. As soon as the concrete has reached an initial set, the outside of the metal lath is plastered to a finish, the protruding concrete from the openings of the metal lath forming a bond for the plaster. When an ordinary plastic mix is used the concrete does not drop through the openings in the meta lath, but protrudes just enough to form this bond.

The operation then continues from floor to roof in orderly manner. The roof, which can be either flat or sloped, is made up of reinforced-concrete girders poured inside metal lath and topped with a metal-lath reinforced slab. The staircases are also made of poured or plastered concrete on metal lath. The only forms required are the struts for the temporary holding of the slab.

Bolt and Rivet Reclamation Facilitated by Simple Chuting System

BOLTS and rivets reclaimed at the yards of the Manitowoc Shipbuilding Co., Manitowoc, Wis., are chuted according to size directly from the refitting benches to trays. Refitting is done on the second floor of the tool shop.

Scrap rivets, used bolts, etc., are collected at the shipbuilding berths in ordinary tin buckets, these being carried to the refitting shop by hand. Sorting is done on a work-bench along the outer wall of the shop, as



BOLT CHUTES AT MANITOWOC SHIPYARD

indicated by the sketch. Bolts sized here are delivered to rethreading machines, and when refitted are returned to be thrown into the proper chute.

Openings about 10 x 15 in. along the back of the bench lead to 15-in. steel pipe chutes which pass downward and through the wall of the shop building. Outside they turn down vertically, ending a foot or so above a plank trough or platform built along the wall about 2 ft. above ground. Partitions of 2 x 4-in. strips divide the trough into a series of trays, one under each chute; the trays are about 24 in. wide and 30 in. long. Each tray is marked with the diameter and the length of the rivet or the bolt, so that the men from the bolting and riveting gang passing to get a stock for their work can pick out at a glance the material which they need.

NEWS OF THE WEEK

New York, December 5, 1918

Would Expedite Highway Development

Secretary of Agriculture Favors Larger Appropriations from the Federal Treasury for Such Work

Coöperative highway construction under the Federal-aid road act must be resumed as quickly as possible and in full measure, stated David F. Houston, secretary of agriculture, to a conference of editors of agricultural journals held in Washington. He cited not only the importance of good roads, but also the desirability of furnishing worthy projects on which to employ labor during the readjustment period. He said that public roads are worthy projects and that it would be to the public interest to make available for road construction larger appropriations from the Federal treasury, to be used separately or in conjunction with state and local support.

"There need be no delay in the execution of such a program," said the secretary; "the nation has already provided the machinery in the Department of Agriculture and in the state highway commissions. The Federal-aid road act was fruitful of good legislation, and each state in the Union now has a central highway authority with power and funds to meet the terms of the Federal act. These two agencies, in conjunction, have been engaged in devising well considered road systems and in making surveys, plans and specifications. The task will be one of selection, and those roads should be designated for improvement which are of the greatest importance, with due regard to such military and other needs as are proper for consideration. There is no necessity for any departure from this scheme. The suggestions made have been canvassed with the President, the Secretary of War, and the Postmaster General, and these officials are in accord with the view that additional funds should be made available to the Department of Agriculture, and that they should be expended through the existing machinery."

From unexpended balances of Federal appropriations for the past two years, from state funds beyond the amount necessary to meet the Federal allotments, and from other money available during the coming fiscal year, approximately $75,000,000 will be available for expenditure during the calendar year. Next year, however, if all the balances are expended during this year and it is necessary to rely solely on the funds accruing next year, there will be only $20,000,000 from Federal appropriations."

American Society Development Committee Divides Work into Four Main Groups

Subcommittees Appointed on Technical Activities, Internal and External Relations and Public Affairs

The Committee on Development of the American Society of Civil Engineers, at its first meeting, Nov. 14, in Chicago, divided its work into four principal groups, appointing a subcommittee for each group. The committee also passed resolutions outlining future work, including recommendations that the society adopt the principle of becoming an active force in national affairs; that the importance of engineering in the reconstruction period should be brought forward nationally, and that the subjects assigned to the subcommittees should be discussed at the annual meeting of the society in January.

An executive committee was appointed, consisting of the following members: Onward Bates, chairman; Baxter L. Brown, W. L. Darling, H. L. Haehl, E. S. Nethercut, Frederick C. Noble and H. R. Safford.

Subcommittee Groups

The four divisions of work assigned to the subcommittees are:

Technical Activities, including (1) meetings, papers, and committee work; (2) sections or divisions of the society for specialized lines of work; (3) coöperation with specialized engineering societies and other organizations, and (4) standards in engineering practice.

Internal Relations and Local Associations, including relations with (1) local associations; (2) coöperation between the society's local associations and those of other national societies and local societies; (3) rearrangement of the grades of membership; (4) student engineers; (5) young men of the profession, and (6) personal service bureau.

External Relations with the Engineering Profession, including relations (1) with other national societies and related organizations; (2) with local societies other than the relations referred to above; (3) amalgamation of engineering societies, and (4) American engineers in foreign service.

Relations to Public Affairs, including (1) professional status of the engineer; (2) legal status of the engineer, and (3) public status of the engineer.

The members of the committee appointed by the chairman to the subcommittees are as follows:

Committee on technical activities, Robert A. Cummings, chairman, and George R. Putnam. The chairman of this subcommittee was authorized to name three other members.

Committee on internal relations and local associations: Frederick C. Noble, chairman; Richard L. Humphrey, George G. Anderson, Edgar S. Nethercut, Gardner S. Williams, Clifford M. Holland, H. L. Haehl, George C. Mason and J. H. Brillhart.

Committee on external relations with the engineering profession: S. Everett Tinkham, chairman; Thomas L. Wilkinson, E. B. Thomas, William H. Hoyt, Arsène Perrilliat, H. R. Safford, and Arthur Pew.

Committee on relations to public affairs: W. L. Darling, chairman; J. C. Ralston, Charles Hansel, George Butler, Frank T. Darrow, C. J. Tilden, John L. Hall, B. L. Brown and Paul G. Brown. This subcommittee may appoint its own divisions.

Asks Full Co-operation

In outlining the manner in which the subcommittees' work would be taken up, the committee's report states:

"The committee is undertaking through its subcommittees a broad survey of the functions and purposes of the society in its relation to its members, to its fellow societies, and to the public. The committee earnestly urges the fullest discussion of the subject by the members of the society, who are requested to communicate any matters of interest to the secretary of the committee.

"It is the intention that the subcommittees shall analyze and study the available data and information, and the recommendations of these subcommittees will be considered by the Committee on Development.

"The committee will keep in close touch with the work of similar committees of the other national engineering societies, and will endeavor so to coördinate its work as to be, as nearly as practicable, in harmony with their action on related matters of common interest. The committee will thereafter submit its final report with its recommendations.

Discussion at Annual Meeting

"In order to assist the subcommittees in their work, it is expected that there will be a discussion of the subject at the annual meeting and also by the local associations. While the committee will be glad to have a discussion of all

the items on its program, it believes that, in view of the limited time available at the annual meeting, the best results will be secured through discussion of the following subjects: Technical activities, relation of the society to its local associations, relation of the society with other national societies and related organizations, and relation of the engineer to public affairs."

The resolutions adopted by the committee included the following: "Resolved, that it is the sense of this committee that the American Society of Civil Engineers should adopt the principle of becoming an active national force in economic, industrial and civic affairs."

Because of the urgency and importance of reconstruction measures at this time, says the report of the committee, resolutions were adopted advocating that "prompt action be taken in providing means for keeping at Washington representatives of the engineering profession charged with the duty of keeping fully advised as to all matters in which the engineering profession should have a voice, and of attempting to secure participation by engineers in the planning of the methods of dealing with reconstruction problems by Governmental agencies or otherwise, including the drafting of bills, and in the carrying out of the work of reconstruction.

"We suggest that the matter be taken up through the executive committee, the committee on reconstruction, or the committee on public affairs of the Engineering Council, or by all of these agencies, and that active work be done at Washington at once."

The committee adjourned to convene in New York on Monday, Jan. 13, preceding the annual meeting of the society.

Capital Issues Committee Favors Highway Construction

Where materials and labor are available, bond issues for the construction of highways and other public improvements will receive favorable consideration, according to a statement given out by the Capital Issues Committee. The economic importance of a project will be a determining factor, and it is thought that public demand for a project will have considerable influence with the committee. The full text of the statement follows:

"The Capital Issues Committee has voted that, hereafter, where material and labor are available, issues for the improvement of highways and for building schools and hospitals and systems for water, sewage, drainage and irrigation, and for improvement of fire and police protection, will receive favorable consideration when economic importance is shown to exist, and that the committee will likewise give favorable consideration to industrial and public utility issues where the improvements contemplated are compatible with readjustment to a peace basis."

Disposition of Railways, Development of Roads and Land Reclamation in President's Address

Threatens Prompt Return of Railroads if Congress Delays—Use of Soldiers in Reclamation Work Advocated

The questions of the disposition and development of the railroads, plans for the reclamation of arid and swamp lands and the development of highways and waterways were the engineering topics in the President's recent address to Congress. He stated that it was not fair either to the public or the owners of the railroads to leave the questions of control unanswered, and asserted it was his duty to relinquish control of the roads before the expiration of the statutory period, unless a clear legislative solution were promptly forthcoming.

The president called attention to some 300,000,000 acres of land that could be made available for cultivation, and suggested the direction of thousands of returning soldiers to the reclamation of the arid, swampy and cut-over areas of the country.

In approaching the subjects, Mr. Wilson brought out the need for prompt and intensive consideration of the reconstruction problems. He pointed to the speed with which the country has moved toward a peace footing in the three weeks since fighting ceased, a speed which threatened to outrun any inquiry that may be instituted and any aid that may be offered. It was for this reason and because of the complexity of the railroad problems that he deemed it necessary to take immediate action himself if the proper solutions were not promptly approached by Congress.

Asks Counsel on Railroads

Although Mr. Wilson stated that the railroad problem caused him the greatest concern, that he went to Congress for counsel—having, as he said, no confident judgment of his own and no answer ready—he outlined a middle course of Government supervision as against the alternatives of private control or absolute Government ownership, and said he was ready to state with confidence that it would be a disservice to the nation and to the owners of the roads to return to the old conditions unmodified, the conditions of restraint without development, in which, he said, there is nothing affirmative or helpful.

In amplifying the three alternatives which, in his opinion, are open, the President stated that they would be, first, simply to release and return the roads to the old conditions of private management, unrestricted competition and multiform state and Federal control; second, to employ the opposite extreme of complete control under Government ownership, or, third, to adopt an intermediate course of modified private control, under more unified public regulation—as, for instance, by regional corporations in which the railways would be in effect a single system in defined areas.

Mr. Wilson is persuaded that the country's chief need lies in a new policy for the development of all means of transportation, railroads, waterways and highways. Whether the old policy be changed much or little, it cannot remain as it was, he said, and he hoped that Congress would institute at once a complete and impartial study of the whole problem and prosecute it as rapidly as possible.

He concluded that part of his address by saying that he was ready and anxious to release the railroads at a very early date. Waiting until the statutory limit was reached would be, he said, hurtful to every interest concerned because of the prolonged doubt and uncertainty.

Advisory Engineers Appointed by Shipping Board

The following is the recently appointed advisory engineering board of the Port and Harbor Facilities Commission of the United States Shipping Board:

General William M. Black, chief engineer, U. S. A., Washington; Col. Bion J. Arnold, Chicago; J. E. Greiner, Baltimore; H. McL. Harding, New York, consulting engineer of New York State Barge Canal Terminals; John Meigs, former commissioner of docks, Philadelphia, and Calvin Tomkins, former commissioner of docks, New York.

The Port and Harbor Facilities Commission was appointed to study and make all practicable recommendations to secure an early, practical and commercial improvement in the existing terminal and port conditions in this country and a greatly increased berthing frontage.

State-wide Water-Waste Survey

Acting for the Connecticut State Council of Defense, Department of Fuel Conservation, Caleb M. Saville, manager and chief engineer of the Hartford Water Department, will make a state-wide survey of water waste in Connecticut and its relation to fuel conservation. It is intended to submit recommendations for legislation on this subject to the next session of the Connecticut legislature.

Places 5565 Engineers in Five Months

Since July 1, when the division of engineering of the United States Employment Service was inaugurated, 5565 technical men have been placed. The monthly placements were as follows: July, 483; August, 1053; September, 1514; October, 1944; one-half of November, 571.

Canadian Contractors Organize at Ottawa Meeting

As the result of a conference held in Ottawa Nov. 27-28 by general contractors, subcontractors and dealers in builders' supplies, an organization was effected under the name of the Association of Canadian Building and Construction Industries. Officers were elected as follows: President, J. P. Anglin; vice-presidents, one for each province, Nova Scotia, J. C. Hardy; New Brunswick, Mr. Grant; Quebec, P. Galarneau; Ontario, Frederick Armstrong; Manitoba, E. Case; Saskatchewan, William Wilson; Alberta, Mr. McKenzie, and British Columbia, Mr. McLean; honorary treasurer, C. A. Crane, Ottawa; honorary secretary, R. H. Dancy, Toronto. Resolutions were adopted urging the Government to proceed without delay with deferred construction work; requesting that no public works should be undertaken except by Canadian contractors—this rule to apply also to all concerns acting for the Government or operating under Dominion charters of incorporation—and that Canadian materials should be used for all Government work.

On Nov. 28 these resolutions were presented to the Government by a deputation from the association. The Hon. F. B. Carvell, minister of public works, in replying to the deputation, stated that it had always been the policy of his department to use Canadian materials in all public works, and that policy would be adhered to in the future. As regards the construction of dry docks, however, the Government could make no promises, as all it could do under the act was to subsidize the company undertaking the work. The Hon. Dr. Reid, minister of railways, said arrangements were already being effected for large expenditures in railway improvements.

National Civic Federation To Study Reconstruction

Samuel Gompers, president of the American Federation of Labor, was the chief speaker at a reconstruction conference held in New York City Dec. 2 under the auspices of the National Civic Federation. "Dangers as grave as if not graver than those during the war confront our people now," he said. "Contentment is stagnation. A healthy discontent is an awakening of aspirations for better things. Hungry stomachs do not make for reasoning brains."

Acting in accordance with a plea made by Frank Morrison, secretary of the American Federation of Labor, the conference passed resolutions, subject to approval by the executive council of the National Civic Federation, favoring the payment by the Federal Government of all volunteer war workers from the time of their discharge to their employment by private industry, together with transportation expenses to their new place of work, and also favoring the prohibition of immigration for a period of five years, or at least until every voluntary war worker and every returning soldier finds employment. Other resolutions requested the executive council of the Federation to appoint a committee on coöperation between employers and employees, which should also consider the efficiency of Government operation of public utilities; also a committee, to be headed by V. Everit Macy, president of the National Civic Federation, to study reconstruction and Government ownership abroad.

The prevailing spirit of the conference was in favor of hearty coöperation between employers and employees. As one speaker put it, group consciousness in this country should be kept down. The war was won by concentration on a single object. If we become dismembered we shall go back to pre-bellum conditions. But if we act on the basis of a composite consciousness we shall go forward. In furtherance of these ideas, the executive council of the National Civic Federation was asked, by resolution, to provide ways and means for harmonizing group differences of opinion.

Mechanical Engineers Hold Annual Meeting in New York

The thirty-ninth annual meeting of the American Society of Mechanical Engineers was held this week in New York City. At the opening session on Tuesday evening the president of the society, Charles T. Main, of Boston, delivered the annual address, taking as his subject, "Broader Opportunities for the Engineer." He dealt especially with the responsibilities now resting upon the engineering profession in the reconstruction and readjustment following the war. The newly elected president of the society, Dr. M. E. Cooley, dean of the colleges of engineering and architecture of the University of Michigan, also addressed the members. Honorary membership in the society was conferred on Charles M. Schwab and Orville Wright.

The other officers whose election was announced are as follows: Vice-Presidents: Fred R. Low, editor of *Power;* Henry B. Sargent, president, Sargent & Co., New Haven; and John A. Stevens, consulting engineer, Lowell, Mass.; managers: Charles L. Newcomb, general manager, Deane Pump Works, Holyoke, Mass.; F. O. Wells, president, Greenfield Tap & Die Corporation, Greenfield, Mass., and Charles R. Richards, dean, College of Engineering, Universiay of Illinois; treasurer, William H. Wiley.

A Billion Dollars for Drainage and Flood Control

At the annual meeting of the National Drainage Congress, to be held at Chicago Dec. 13-14, Congress will be asked, according to present intention, for an appropriation of $1,000,000,000 for land drainage, river regulation, flood control and the national development of natural resources, water power and unused lands.

Engineering News-Record War Correspondent Commissioned

Robert K. Tomlin, Jr., previously managing editor of *Engineering News-Record*, who went to France in December, 1917, to become war correspondent of this journal and Paris representative of the McGraw-Hill Co., Inc., has been commissioned in the Corps of Engineers with the rank of captain and is now stationed at Tours, France. His work is to compile the military engineering history of the American Expeditionary Forces, which he entered Sept. 1.

Mr. Tomlin was graduated from Harvard University in 1907 with the degree of B. S. in Civil Engineering. During his course he served as instructor two summers in surveying and field engineering work at the Harvard engineering camp, Squam Lake, New Hampshire. His next work was in the tunnels of the Pennsylvania R.R. under the East River, New York City, and in the crosstown tunnels leading to the Pennsylvania terminal. He left the Pennsylvania to join the staff of the Catskill Aqueduct, where he served in the executive division of the Northern Aqueduct Department, New York Board of Water Supply, at Poughkeepsie. In March, 1909, he became assistant to the editor of *Engineering Record*, later becoming associate editor assigned to the municipal and sanitary engineering fields. In 1913 he became managing editor of *Engineering Record* and in April, 1917, at the time of the consolidation of *Engineering News* and *Engineering Record* he became managing editor of this journal.

Proposes Corporation to Unite Engineering Societies

W. H. Woodbury, in collaboration with W. A. Clark and O. H. Dickerson, all members of the American Society of Civil Engineers, has submitted in a letter to Alfred D. Flinn, secretary of the Engineering Council, a complete set of articles of incorporation for a proposed "United Engineering Societies of America."

Both the civil engineering and the electrical engineering societies have committees on development working on problems of wider usefulness. The purpose of the proposed United Societies is stated to be to create an instrument "by which united action can be obtained by members of the engineering profession, their associates, assistants, and organizations throughout the American continent, upon all matters relating to engineering, engineers and allied enterprises and persons, for general benefit and improvement." Its plan of operation shall be "to maintain clubrooms, clubhouses, buildings, and grounds in connection therewith, and to hold such technical and social meetings as may aid in carrying out its general purpose and object."

The government and management of affairs in the proposed society shall be vested in a body of delegates, with one delegate for each state having a

membership of one hundred, plus one delegate for each four hundred members in excess of one hundred. Delegates are to be elected for a term of two years and recalled at the pleasure of their constituents. Membership is divided into the following classes: Members, associates, juniors and affiliated associations. It is stated that "membership in an affiliated association shall confer upon the individual member all the rights and privileges of direct membership, subject to the same requirements as to professional training and experience. An affiliated association may be a national society, local club, state association, subsection or subordinate section of a national or state society."

Mr. Flinn, in commenting on this announcement, lists the following cardinal elements desired for such a national society: (1) Autonomous local, state and national societies; (2) membership of any society in a representative national association, embracing all engineers; (3) membership for individuals who do not wish to be members in any other society; (4) combined action in local, state and national matters—civic, professional and social—of common concern to engineers; (5) a scheme for representation and membership in the United Societies which will prevent any person being counted more than once; (6) common standards for membership of various grades in all member societies and the United Societies; (7) inducement to membership in the United Societies through a national or other society, by the adjustment of views. To these Mr. Woodbury adds: (8) Direct responsible representation and (9) definite organized action to better the engineer's economic condition.

Urges McAdoo To Recognize Engineers' Services

In a letter to William G. McAdoo, director general of railroads, Alfred D. Flinn, as secretary of the Engineering Council, asks early action upon the classification and compensation of civil, mechanical and electrical engineers and their technical assistants on the staffs of the railroads. He states that a number of engineers have brought to the attention of the Engineering Council the fact that the schedules in "Wages of Railroad Employees" and supplements thereto, as issued by the Railroad Administration, do not mention the men performing engineering services.

After admitting that such omission may be due to accident or oversight, which omission is too often the reward for quiet, industrious modesty competing with insistent, organized demands, Mr. Flinn requests that "technical engineers be given suitable separate classification with rates of compensation in accord with their duties and the expense to which they have been put for their education and their training in preparation for their present duties and responsibilities."

Engineering Societies Establish Employment Bureau

Replying to Letter on Reconstruction Commission, President Wilson Favors Existing Machinery

At a special meeting of the Engineering Council called to meet on Nov. 21 to determine approximate limitations on its field of activity, and to consider a working program, it was decided that an Engineering Societies' Employment Bureau should be established at once, principally to meet the new need which has arisen for an agency to aid engineers who have been in military service to find suitable positions. The four secretaries of the founder societies of the United Engineering Society are appointed as the board of managers, and Walter V. Brown is made secretary in immediate charge. This action was taken as the result of the joint meeting held the preceding day by the secretaries of the founder societies and the American Engineering Service. The resolutions further provided that the American Engineering Service be instructed to turn over its entire office equipment and records and instruct its operating staff to report for further service to the bureau when organized, and that thereupon the American Engineering Service be automatically discharged. It was determined that the work should be started on the basis of no charge, with headquarters in the Engineering Societies Building, New York.

Praise for Engineering Service

The work of the American Engineering Service was cited as having been of inestimable value to the Government through the coöperation between the four founder societies and the Government, and a resolution was passed expressing high appreciation of the accomplishments of George J. Foran and his associates during his chairmanship.

As defining the field of activity of the Engineering Council, the following resolution was passed: "The Engineering Council understands its field of activity to be approximately as follows: (1) Council may deal with any matter of general interest for which joint action of two or more of its member societies would have been appropriate, if Council had not been established; (2) Council may initiate and carry through projects of the general character defined in the by-laws, for which the necessary financial provision has been made; but Council shall not undertake expenditures in excess of appropriations for its uses made by the United Engineering Society on behalf of the founder societies and the contributions from other member societies, unless specific provision shall have been made therefor by subscription, donation or otherwise; moneys received by Engineering Council shall be turned into the treasury of United Engineering Society and disbursed by it, for the purposes designated; (3) Council may take up, and in its discretion act upon any matter of general interest referred to it by any member society or by any other society, national, state or local, or any branch of Government, or by any individual or group of individuals."

It was further resolved "that Engineering Council will as a rule avoid considering any matter which is specifically within the province of only one member society and not of the others."

A letter was addressed to President Wilson on Nov. 15 by J. Parke Channing, in which he said, in part:

"I am advised that you have under consideration the appointment of a reconstruction commission to develop a comprehensive program for the nation's conversion from a war to a peace basis.

"As chairman of Engineering Council, I respectfully ask that you consider the appointment of at least one engineer upon this commission, basing my recommendation upon the fact that all construction and practically all manufacturing is under the management of engineers."

Under date of Nov. 20 the following reply was received from the White House:

"My dear Mr. Channing:

"I have your letter of Nov. 15, which Mr. Rickard has been kind enough to hand me. You may rest assured that I realize what a service engineers can render in reconstruction problems from time to time. We are handling reconstruction questions just now by a process of consultation between existing instrumentalities, which I hope will prove useful and effective.

"Cordially and sincerely yours,

"Woodrow Wilson."

It was voted to abolish the War Committee of Technical Societies, and the chairman and the members of the committee were thanked for their patriotic service.

Government Lets Contracts for Mississippi Barges

Contracts have been let for the building of 40 steel barges and six towboats for use on the Mississippi River, through the inland waterways division, United States Railroad Administration. The contracts have been awarded as follows: Fifteen steel barges, Dravo Construction Co., Pittsburgh; 25 steel barges, American Bridge Co., Pittsburgh; four towboats, Marietta Manufacturing Co., Point Pleasant, W. Va.; two towboats, Charles Ward Engineering Works, Charleston, W. Va. These contracts represent a cost of approximately $6,170,000.

In tests a year ago one river boat towed 12 barges, each carrying 590 tons of freight cars for service in France, from St. Louis to New Orleans, at what was claimed to be a 50% saving in time and 30% saving in cost. At present there are five boats and 15 barges in operation making regular trips under the Railroad Administration.

Americans to Rebuild Grand Canal of China

Siems-Carey Company Engineers Making Extensive Survey to Meet Modern Conditions

One of the most remarkable enterprises in the field of hydraulic engineering now under way anywhere in the world is the repair and modernizing of the Grand Canal of China. This is not only the longest canal in the world, but the oldest. The first and most important section was completed about 540 years before the Christian era. The Grand Canal with its feeders constitutes the greatest artificial inland waterway system in the world. The main canal itself is nearly 1000 miles long, extending from the great commercial city of Hanchow, south of Shanghai, north to Peking. Besides the main canal, there are hundreds of miles of feeder canals.

Canal Nearly 2500 Years Old

For part of the distance the canal was built by dredging and straightening the channels of small, natural streams, but hundreds of miles were built entirely by artificial excavation in the great plain which forms the delta of the Hoang-Ho or Yellow River. The navigable channel of the canal is 50 to 100 ft. wide and about 6 ft. deep, about the same as that of the old Erie Canal. Much of the system was constructed, as noted above, nearly 2500 years ago, and extensions were made in the fifth and seventh centuries of the Christian era.

When the great flood of sixty years ago occurred in the Yellow River many miles of the canal were filled with mud, but the southern half still floats thousands of cargo boats and affords probably the cheapest inland waterway transportation in the world. On this portion of the canal vast quantities of rice, tea, coal, salt and oil are carried in small barges propelled either by sails or by men hauling tow ropes or wielding poles. Only a few years ago the Standard Oil Co. operated a fleet of 500 boats carrying oil on this portion of the canal.

Operation of the Locks

The locks on this ancient canal are built of the highest quality of granite masonry, much of it equal to the finest ornamental work in a modern city park. Mechanically, however, the locks are crudity itself, their construction antedating, of course, the double-gate lock chamber invented by Leonardo da Vinci. The Chinese lock gates are merely a single set of individual stop logs extending crosswise of the lock chamber from wall to wall, their ends resting in grooves in the granite masonry on either side. The total height of lockage is commonly about 5 or 6 ft. Boats are not locked through until a considerable fleet has accumulated in the basins on either side. To open the gate the stop logs are pulled out one by one by means of ropes hauled by man-power. Boats in the upper basin then ride down the swift current between the lock walls, and then the boats on the lower side are pulled up against the current by long ropes of bamboo hauled by scores of hands.

One of the obvious tasks in modernizing this old canal is to substitute modern locks for these ancient ones. In many places, where the topography permits, several lifts will be consolidated into one. Dredging and other work will, of course, be required to fit the canal for modern requirements.

The most difficult problem of all in connection with the canal is the matter of flood control where the waterway is crossed by "China's sorrow," the Yellow River. The enterprise is too vast to be undertaken immediately as a whole, in China's present financial condition. What is now being done is to make thorough surveys of the whole length of the canal and work out a comprehensive engineering scheme for the entire improvement, and then select some section, perhaps 100 miles in length, where the funds now available for improvement, about $6,000,000, will yield the best return in the improvement of traffic and the drainage or irrigation of the wonderfully fertile lands along the canal.

American Engineers on Work

A contract for carrying out these improvements has been made between the Chinese Government and the Siems-Carey Canal & Railway Co., a subsidiary of the American International Corporation of New York City. John R. Freeman, of Providence, R. I., began the study of this problem soon after his return from China a year and a half ago, and is acting as consulting engineer to the American International Co. in carrying on these investigations. For some two months an organization of American engineers has been at work in China collecting preliminary data, using as a basis the investigations made by the Chinese South Grand Canal Conservancy Bureau which, under the direction of a wealthy Chinese, Pan Fu, has been making surveys of this region for the past three years.

The chief engineer is Joseph Ripley, who was for years superintendent of the United States Government canals at Sault Ste. Marie and was a member of the International Commission which dealt with the Panama Canal. He has been for several years senior consulting engineer for the New York Barge Canal. The assistant chief engineer is J. W. Beardsley, who is especially familiar with conditions in the Orient through his five years' service as Director of Public Works in the Philippine Islands. Other important members of the organization are R. H. Merrill, former division engineer on the New York State Barge Canal; R. D. Goodrich, formerly deputy state engineer of Wyoming and later city engineer of Lansing, Mich., and H. Brodie and H. B. Merrick, from the engineering faculty of the University of Michigan. Mr. Freeman has general charge of these investigations.

Reconstruction Platform Adopted at Rochester

Conference Looks to Holding War-Time Gains, for Efficiency and Humanity, Made Under Federal Control

Crystallizing the thoughts advanced at the Rochester reconstruction conference held by the National Municipal League Nov. 20-22, the following platform was adopted:

During the war, as measures of necessary national efficiency, numerous matters formerly within private control passed to the control of the people. Some of these things should undoubtedly be returned promptly to private enterprise, but the American people will miss a great opportunity if they allow certain of these temporary powers to slip through their fingers in the next few months, namely:

1. The long desired Federal employment service has been created, and the national Government has assumed responsibility for connecting employers and workers in the only right and efficient way. This service should be encouraged to extend its sphere to include the education of employers in modern principles of employment.

2. Corporations, particularly those doing an interstate business, have become a great source of Federal revenue, and may reasonably be expected to continue to be such. Federal control and supervision of their practices should be continued and extended, for they create national, not merely statewide, problems. Effort shall be made to free them from conflicting and ineffectual state regulation by a Federal incorporation procedure.

Future Control Advocated

3. The Government has assumed control of railroads, telegraphs and telephones, opening the opportunity for either Federal ownership with private operation, or Federal ownership with Federal operation, or a reorganization by economical regional systems under a method of control that will protect the private capital by insuring a reasonable return, yet removing speculative and anti-social features of the private ownership of the past with its relatively feeble and negative system of regulation. Whichever principle is adopted is a smaller matter than that the essential features of our present control should never be relinquished.

4. The Federal Government has acquired by its merchant fleet and its War Trade Board intimate knowledge and capacity for mobilizing our resources for foreign trade. Factors which will be valuable in normal peace times should be retained.

5. The Federal Government through its Food and Fuel Administrations and its War Industries Board acquired a command over basic resources which played a vital part in securing national efficiency. Every effort should be made to preserve the nucleus of these valuable agencies in such form and with

such powers that we may achieve some part of that efficiency in peace.

6. The Federal Government has manifested grave interest and exerted its war powers to influence the cost of living and prevent profiteering. It should continue to exert its peace powers toward the same beneficent end.

7. The Federal Government has concerned itself effectively in the problem of housing industrial workers, and has placed upon a new basis of prestige and authority the American movement for garden cities and suburbs. Its interest in this aspect of the welfare of the workers and the efficiency of industry should not now lapse, but the Labor Department's bureau of industrial housing should be continued and its powers broadened to include educational work and research into our vast industrial housing problems.

8. As a measure of protecting the effectiveness of its soldiers and industrial workers, the Federal Government has found it necessary to use its influence with local governments regarding moral and health conditions. Such Federal interest in local governments should not lapse, but should eventuate in the continued attack upon vice problems by the Public Health Service and in the formation of a Federal bureau of municipalities in the Department of the Interior to collect and distribute information on municipal matters.

Transport Committee Inquires Into Highway Snow Removal

An inquiry into the possibilities of snow removal on the main highways of the country has been instituted by the Highways Transport Committee of the Council of National Defense. The committee has formed a definite program of removal, based upon the realization of the importance of unhampered highway transportation in the delivery of foodstuffs both for home consumption and for shipment to our allies, and requests the coöperation of the states where trouble from snow is to be expected. The general subjects of inquiry, as set forth by Raymond Beck, the committee's field engineer, follow:

1. As to the powers of the state highway department or commission for removing snow: If such powers are not specifically covered by statutes, whether maintenance funds can be used in an emergency?

2. What coöperation and work can and will be undertaken by the counties and state?

3. What coöperation and work can and will be undertaken by the municipalities and state?

4. What snow-removal machinery, such as scrapers, plows, etc., are available for use by state, county and municipalities?

5. What preliminary measures can be undertaken which will prevent the drifting of snow, such as location and erection of snow fences and the elimination of air-obstructing hedges and fences which cause objectionable drifting?

6. Attention by state highway department or commission, through its field organization and in coöperation with the state Highways Transport Committee, to physical conditions along the highways tending to cause drifts; recommendations as to the best means of dealing with same by preventive methods.

7. The making of a snow-removal report on every snow storm on such highways as are designated to be kept free from obstruction by snow, so as to allow continuous essential highways transportation.

Merge Canadian Government Railway Systems

The Hon. J. D. Reid, Canadian minister of railways, announced that the management and operation of the Government railways, consisting of the Intercolonial and its branch lines and the National Transcontinental between Winnipeg and Moncton, N. B., have been transferred to the board of directors appointed to manage the Canadian Northern Ry. system.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston; Dec. 9, Chicago.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; A. Dennis Williams, Morgantown, W. Va., acting secretary; Dec. 9-13, Chicago.

AMERICAN SOCIETY OF CIVIL ENGINEERS; 29 West 39th St., New York City; Jan. 15-16, New York.

AMERICAN ROAD BUILDERS' ASSOCIATION; 150 Nassau St., New York City; Feb. 25-28, New York City.

The Society of Automotive Engineers will hold its winter meeting in New York Jan. 12-14. The technical sessions will be devoted to war and post-war subjects, and the views of many men who have been engaged actively in France with our Army, or with the allies, will be given. A number of scientific subjects relating intimately to the automotive industry will be discussed. Among them are topics such as types of post-war automobiles, thermodynamics of internal combustion engines, road tractors, and facts ascertained from the use of motor trucks in the war as affecting commercial practice. The meeting will be held at the Hotel Astor.

The San Francisco Association of Members of the American Society of Civil Engineers held a special meeting Nov. 15 to consider the question of licensing engineers and to discuss the future policy of the organization toward the draftsmen's union. After a general discussion it was decided to prepare a licensing bill.

The Canadian National Safety League has been incorporated by Lucien B. Howland, Colin A. Campbell, Arthur Hewitt, W. J. L. McKay and John F. H. Wyse, all of Toronto, with head office in Toronto, for the purpose of safeguarding the public from danger from automobiles, railroads, street railways and all forms of vehicular traffic.

The Washington Irrigation Institute will hold its sixth annual meeting in Yakima, Dec. 17-18, at the time of the meeting of the Washington State Land Association. Plans for the development by returned soldiers of the arid and logged-off lands of the state will be discussed.

The Engineers' Club of Philadelphia will hold a regular meeting Dec. 17, at which Frederick K. Morris, of Columbia University, will read a paper entitled "The Fourth Year," illustrated with motion pictures and lantern slides. Mr. Morris will present a brief review of the events leading up to the war situation existing at the beginning of 1918, following this in detail with a discussion of the strategy employed by both sides in the past few months. Thomas F. Armstrong will read a paper on "Guilty or Not Guilty" at the weekly luncheon of the club, to be held Dec. 10.

The Providence Engineering Society, Providence, R. I., was addressed by Harlow C. Clark, editor of the official publication of the American Electric Railway Association, on Nov. 26. John McCormick of the city highway department of Providence was elected secretary of the society, succeeding Leroy Meehan, resigned.

The Texas Association of Members of the American Society of Civil Engineers will hold its semi-annual meeting at Dallas, Dec. 13-14.

The Engineers' Club of Trenton, N. J., held a special meeting Nov. 25, at which Lieut. James H. H. Muirhead, British Royal Engineers, read a paper on "Personal Recollections of War Operations on Inland Waterways, Particularly with Reference to the Human Element."

The Oregon Irrigation Congress will hold its annual meeting at Salem, Ore., Jan. 9-11, preceding the opening of the legislature. J. W. Brewer, Portland, is chairman of the committee in charge of the program.

The Houston Engineers' Club was addressed Nov. 27 by Lieut. A. W. Landstrum, who spoke on "A Brief Survey of the Sewage-Disposal Situation in the Air Service, United States Army."

PERSONAL NOTES

JOHN R. FREEMAN, Providence, R. I., has resigned the presidency of the Providence Gas Co. The resignation will take effect Jan. 1, and Mr. Freeman will be succeeded by Charles H. Manchester, at present vice president and treasurer of the company. Mr. Freeman became president May 14, 1917, succeeding the late John W. Ellis. He has also acted as chief engineer, and under his direction a new coal gas plant has been constructed for the company. Mr. Freeman resigns his position in order that he may be free to undertake the responsibilities in connection with his work as consulting engineer for the improvement and modernization of the Grand Canal of China, which is being undertaken by the American International Corporation of New York City, as described on p. 1049.

JOHN H. LEWIS, state engineer of Oregon, has resigned to become chief engineer and general manager of the Warmsprings Irrigation District, Malheur County, Oregon. Mr. Lewis has served 14 years as state engineer; he left the employ of the United States Reclamation Service in 1904.

J. L. HAUGH, engineer of capital expenditures, Northwestern Region, United States Railroad Administration, has been appointed engineering assistant to the Regional Director, with headquarters in Chicago, succeeding Ralph Budd, who resigned to become chairman of the board of directors of the Chicago, Burlington & Quincy R.R., as mentioned in *Engineering News-Record* of Aug. 15, p. 338. Mr. Haugh has been acting as engineering assistant to the Regional Director since Mr. Budd's resignation.

PERCY A. CUPPER, previously assistant state engineer of Oregon, is the successor as state engineer of John H. Lewis, who has resigned to become chief engineer and general manager of the Warmsprings Irrigation District, Malheur County, Oregon, as noted elsewhere. Mr. Cupper was recently elected superintendent of Water Division No. 1. As a result of Mr. Cupper's appointment as state engineer, it is expected that the Governor will recommend to the next legislature that the office of water division superintendent in the western district be merged with the office of the state engineer.

T. J. WYCHE, chief engineer, Western Pacific R.R., under Federal Manager W. R. Scott, of the combined Southern Pacific-Western Pacific, has resigned to become chief engineer of the Western Pacific's corporate interests and of the Denver and Rio Grande. Mr. Wyche will divide his time between San Francisco and Salt Lake City.

WILLIAM M. KINNEY, inspecting engineer, Universal Portland Cement Co., has been appointed general manager of the Portland Cement Association, succeeding H. E. Hilts, resigned. Mr. Kinney was born in 1885, and is a graduate of the Lewis Institute, Chicago. In 1906 he entered the service of the Willamette Iron & Steel Works, Portland, Ore., as a draftsman, and was later employed by the Universal Portland Cement Co. in the inspection bureau. From 1908-14 he was

WILLIAM M. KINNEY

assistant inspecting engineer for the company at Pittsburgh. Afterward he became inspecting engineer and engineer of the information bureau of the company. He is vice-chairman of the committee on cement of the American Society for Testing Materials and is secretary of the committee on concrete roads and pavements of the American Concrete Institute.

C. E. COX, valuation department, Chicago, Milwaukee & St. Paul Ry., has been appointed engineer of capital expenditures, Northwestern Region, United States Railroad Administration, succeeding J. L. Haugh, who has been appointed engineering assistant to the Regional Director, as noted elsewhere.

JAMES W. COSTELLO, previously connected with the city engineering department of Philadelphia, is now director of municipal hygiene, Newark, N. J. He will have charge of street cleaning and refuse disposal.

ANDREW GORHAM TAYLOR, assistant United States engineer, Duluth district, succeeds Clarence Coleman, whose death was noted in *Engineering News-Record* of Nov. 7, p. 871, as engineer of the district.

H. W. BROWN, division engineer, Pennsylvania Lines West, with office at Zanesville, Ohio, was recently appointed also division engineer, Ohio River & Western Railway.

WILLARD A. BURTON was appointed recently assistant engineer, Kansas State Board of Health, in charge of inspection of water-supply and sewage-disposal plants.

C. S. TILLETT has been appointed acting signal engineer of the Grand Trunk Ry. system, with headquarters in Montreal, in succession to B. Wheelwright, who has been appointed engineer maintenance of way of the Grand Trunk lines in New England.

W. C. MARION has been appointed county engineer with headquarters at Yakima, Wash., succeeding Lieut. O. E. Brashears, who resigned to enter military service.

GEORGE B. HUGHES, district county road engineer at Ely, Minn., has been appointed city engineer of Ely, succeeding Charles A. Nutter, resigned.

F. A. COLLAR has been appointed assistant division engineer, Ohio River & Western Railway.

OBITUARY

CAPT. MYRON H. PECK, Second Engineers, U. S. A., was killed in action in France Oct. 9. He received his technical training at the University of California, being graduated in 1897. For several years he was professor of civil engineering at the Imperial University in Pekin. He returned to the United States in 1910 and engaged in various engineering work, including jetty construction at the mouth of the Columbia River and the improvement of the channel at Mare Island. He was commissioned second lieutenant of engineers in the National Guard of California in 1916 and saw service on the Mexican border. Later he entered the Engineer Officers' Reserve Corps and was assigned to Camp Lee, Virginia. From there he sailed for France early in January of this year.

PROF. W. MUIR EDWARDS of the University of Alberta, died at Edmonton Nov. 14. He was 40 years old and was born at Montreal. In 1900 he was graduated from McGill university, winning the British Association medal in applied science. After some practical experience in engineering he became lecturer and afterward assistant professor at McGill University. From that position he was called to become professor of civil and municipal engineering in the University of Alberta.

WILLIAM W. KILLOUGH, previously chief engineer of the Charlotte water-works, Charlotte, N. C., died in that city Nov. 20.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

New Liquid Fuel Developed by Army Engineers

Shows Higher Efficiency Than Gasoline in Automobile, Airplane and Stationary Engine Tests

The development by the research and development division of the General Engineer Depot of a new liquid hydrocarbon, which has been named "Liberty fuel," is reported from Washington, D. C. The report states that under extensive tests in automobiles, motor cycles, trucks, tractors, stationary engines and hydroplanes, and under wide variations of weather, loading and operation, the new fuel developed an average greater thermal efficiency than the best gasoline.

It has been developed under the direction of Maj. O. B. Zimmerman, the specific problems having been solved by Capt. E. C. Weisgerber, in charge of the chemical section of the Research and Development Division. Captain Weisgerber, it is stated, is a gas and oil engineer of extensive technical and practical experience, and is considered by the division as one of its most practical thinkers in solving chemical problems, having specialized in the hydrocarbons. The fuel is a result of several years' work and tests in the laboratories of the Bureau of Standards, Washington. The report states that it explodes at temperatures below zero, requires less air or oxygen and leaves less carbon residue than any gasoline.

In operation with the "Liberty fuel" the engine works more easily than with gasoline, the mileage per gallon in various types of machines is uniformly greater, and no deteriorating effects have been noted on the lubrication.

It is said that the cost of manufacture will be less than that of gasoline at present; the raw materials used are plentiful and can be easily obtained. Therefore, although the process is still new, it is believed that the supply, when production is put on a commercial basis, will be ample.

Restrictions on the Use of Coal Still Further Reduced

War restrictions on the use of coal have been removed still further by the Fuel Administration. By the recent ruling the manufacturers of window glass, clay products and cement may use as much fuel as they need. The order went into effect Dec. 2. Under the original orders, manufacturers of window glass were compelled to reduce their use of coal 50 per cent., makers of clay products from 15 to 50 per cent., and makers of cement 25 per cent.

Chairman Baruch Resigns from The War Industries Board

Bernard M. Baruch, chairman of the War Industries Board, has forwarded his resignation to President Wilson, to take effect Jan. 1, 1919. No announcement of acceptance has been made.

The restrictions placed on industry made necessary to complete the war program having been removed, and the board's activities having been curtailed as rapidly as its relations with industries permitted, Mr. Baruch felt that his services as chairman could be spared. It is stated that it was this reason, and not the desire of the President to name him as Secretary of the Treasury, that caused Mr. Baruch to resign.

Reducing the Personnel of the Fuel Administration

A reduction of the personnel of the Fuel Administration will be effected by the transfer of certain sections to other regular Government departments. The statistical bureau will be taken over immediately by the Geological Survey, and the conservation bureau and the engineering program by the Bureau of Mines. The assurance of a normal coal supply for the country makes this reduction possible. An index of the approach of normal conditions is afforded by the return of anthracite miners from the Army to their work in the mines. Miners to the number of 231 were recently released from Camp Dix, 145 from Camp Lee, 105 from Camp Shelby, 87 from Camp Upton and 22 from Camp Mills.

Survey of Labor Situation To Be Made by Employment Service

An immediate survey of the labor situation in industrial centers throughout the country will be made by the United States Employment Service, according to a statement issued by the Department of Labor. The machinery for this survey has been set in motion by the Employment Service at the request of the Secretary of War and the Chairman of the War Industries Board.

The purpose of the information sought is, it is said, to enable the War Department and the War Industries Board as far as possible to avoid labor difficulties through the too rapid curtailment of war contracts and demobilization of the Army. It is expected that the information will give the Government a view of the immediate labor situation, so it will know as early as possible in which centers there is a shortage or a surplus of labor, and how rapidly demobilization in these centers can be effected.

Treasury Department Delays War Contract Cancellation

Agreement to Terminate Contracts on 75 Per Cent. Payment Basis Not Approved by Comptroller

Disapproval by the Comptroller of the Treasury of certain plans of the War Department will delay the liquidating of unfinished war contracts. The form of the agreement which is disapproved provides that the United States shall pay to the contractor 75 per cent. of the minimum amount fixed by the contracting officer as that to which the contractor is entitled. In addition it provides for the payment of a sum not to exceed 10 per cent. of the cost of the unfinished article, as a reimbursement to the contractor for expenses and obligations incurred.

In the letter from the Secretary of War to the Comptroller of the Treasury which brought forth the decision, it is explained there are numerous contracts outstanding for munitions which, on account of the ending of hostilities, must be terminated. He also states that it is his opinion that since many war contractors are willing to forego prospective profits on the remainder of the work and terminate the existing contracts, it should be done on a basis which would amount substantially to compensation for expenses incurred plus a fair profit not to exceed 10 per cent. of the cost of the unfinished article on hand.

CONTRACTORS' ESTIMATES NOT CONCLUSIVE

The Comptroller writes in part, in his reply to the Secretary of War:

"Having no authority to decide the form of contracts, the only question properly before this office is whether a payment may be authorized, the sum being 75 per cent. of the amount found by the contracting officer to be the minimum amount for which the contractor is entitled to be reimbursed. The making of the supplemental agreement and the simple certifying of the amount by the contracting officer from the statement and estimate of the contractor will not be sufficient nor conclusive upon the contracting officer."

There are further difficulties in the situation, brought out in another part of the decision, in that orders for war materials have not been legally executed unless signed by Government contracting agents and the contractors. By this ruling orders for war materials running into large amounts are rendered open to question, because in the rush of carrying out the enlarged war program many orders were communicated to the manufacturer by tele-

phone, telegraph, or letter, and had not been reduced to contract form when the armistice was signed and the demand ceased. The decision therefore makes it impossible to terminate the contracts on the basis on which the War Department intended to proceed. The Secretary of War was asked how many contracts lacked the necessary clauses and signatures. He replied that he did not know the number, but that he thought it was not large.

Highway Industry Forms Reconstruction Committee

A Highway Industries War Service and Reconstruction Committee was appointed by S. M. Williams, president of the Highway Industries Association, to coöperate with similar committees of American industry in a conference during the present week at Atlantic City, N. J. This conference is held under the auspices of the National Chamber of Commerce. It is hoped that an impetus will be given to highway work throughout the country, through the interest aroused at this conference and at the convention to be held next week in Chicago, and that official Washington, being aroused to its importance, will give highway development the prominent place which it deserves in Governmental affairs. The personnel of the committee and the associations which the various divisions represent are as follows:

Representing the Highway Industries Association, its executive committee, as follows: W. T. White, Cleveland, Ohio; A. N. Johnson, Chicago, Ill.; W. P. Blair, Cleveland, Ohio; A. P. Sandles, Columbus, Ohio; A. R. Hirst, Madison, Wis.; E. J. Mehren, New York, N. Y.; S. T. Henry, Washington, D. C.; H. G. Shirley, Washington, D. C.

Representing the American Association of State Highway Officials, its executive committee, as follows: Lt.-Col. W. D. Uhler, Washington, D. C.; G. P. Coleman, Richmond, Va.; W. G. Thompson, Trenton, N. J.; J. N. Mackall, Baltimore, Md.; C. F. Stern, Sacramento, Cal.; P. D. Sargent, Augusta, Me.; W. S. Keller, Birmingham, Ala.; Ira L. Browning, Salt Lake City, Utah; E. Duffy, Albany, N. Y.; Max L. Cunningham, Oklahoma City, Okla.

Representing the American Automobile Association, its executive committee, as follows: David Jameson, president, New Castle, Pa.; A. E. Batchelder, executive chairman, Washington, D. C.; Carl J. Fisher, chairman, touring board, Indianapolis, Ind.; George C. Diehl, chairman, good roads board, Buffalo, N. Y.; Eugene Burton, chairman, legislative committee, Newark, N. J.

Representing the Highway Transport Committee, Roy D. Chapin, chairman, Highway Transport Committee, Washington, D. C.

Representing the Office of Public Roads, L. W. Page, director, Office of Public Roads, Washington, D. C.

Prices Stationary—Federal Control Lifting and Government Work Starting

No Marked Decline in Sight, and Probably Little Change Until Spring, Is Opinion of Material Dealers and Users

That there is no marked indication of a general decline in prices, and that the situation would continue so until spring, is the opinion of the majority of producers and consumers consulted in New York. Inquiries were made of a number of representatives of various industries, who state that, although there is hesitation, the quiet market is more or less seasonal. The administration, however, is lifting war restrictions and advertising a large amount of construction work.

The price agreement between the steel producers and the War Industries Board will continue until Dec. 31, the end of the quarter-year period for which prices have usually been fixed. It is believed that price-fixing by the War Industries Board will cease at that time but, as pointed out by the President in his recent address to Congress, it is impossible to state to what extent priorities and other supervision will be necessary to fulfill the shipping and other requirements in connection with the reconstruction period in Europe, the shipping of Army supplies and the return of troops. The almost universal use of steel makes the unfilled steel orders an index of trade, but as yet it has been impossible to judge the extent with which the reconstruction demand for steel will offset or balance the cancellation of unfilled Government orders. It is reported that the shipment of ore on the Great Lakes will close earlier this season than in several years.

The price of finished lump lime which last month was $2.70 is now $2.90, and an equal advance is noted in common lime, which has advanced from $2.45 to $2.65. Producers state that this is due to the general increase in the cost of materials and labor. The price of 10c. for barrel charge remains the same. The only increase in cement is due to the increased charge for bags, the average quotation from 23 cities being $3.40, including the bags. A sharp decline in hypochlorite of lime, or bleaching powder, from 6½c. to 3c., is noted. The producers state that it is difficult to explain it, save that the cessation of hostilities terminated the heavy demand from the Federal Government. On the other hand, crushed-stone producers state that there will be no reduction in the price of their product; at present there is no demand, and none, they say, could be created by a reduction. The present price will, therefore, remain until the opening of the construction season will indicate the demand on which to base prices.

Public works and foreign trade, it is pointed out, must be the stabilizers in this period of transition. Although less than a month has elapsed since the end of fighting, the Supervising Architect has already set dates for the opening of bids on postoffices and public buildings that will run into many millions of dollars. This is the result of the foresighted preparations for the resumption of activities he has made in his office ever since the order to cease active operations was given when war was declared. The Secretary of Agriculture has indicated the willingness of the administration to enter into active Federal road construction and the Navy Department is proceeding with the expansion decided upon before the war started.

As to foreign trade, the Department of Commerce in a recent bulletin stated that France alone would spend $700,000,000 immediately in reconstruction work, and that the coöperation of American manufacturers was essential. Spain is restricting the export of construction materials and machinery, thus indicating an acute situation in that country.

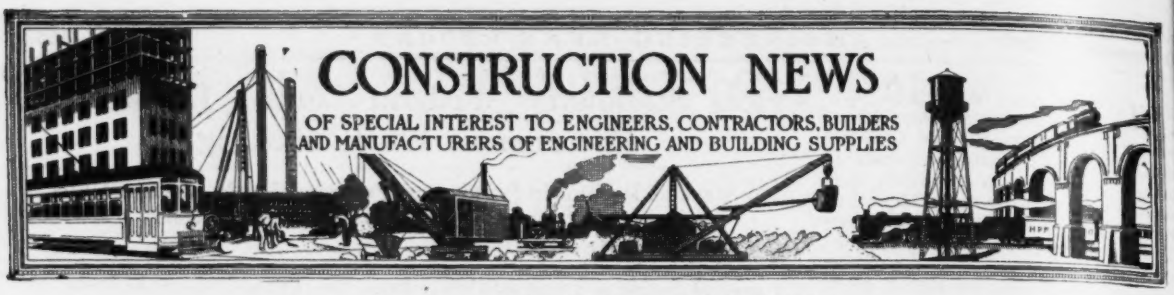
BUSINESS NOTES

H. L. Wraight, 1016 Woolworth Building, New York, has been named local representative for the American Nitrogen Products Company.

The McClintic-Marshall Export Co. has been formed to sell, in the foreign field, the products of the McClintic-Marshall Co. and the Riter Conley Co., with sales office at 50 Church St., New York. The office will be in charge of R. W. Knight, formerly contracting engineer for the Pittsburgh district.

The Associated Metal Lath Manufacturers, Zenas W. Carter, commissioner, announce the removal of their general offices from 901 Swetland Building, Cleveland, Ohio, to Rooms 813-815, Woodward Building, Washington, D. C. Information regarding the use of metal lath, for either stucco exterior or plaster interior construction, for housing or commercial buildings, will be furnished free at all times, upon request to the association.

John Brooks Emory, general superintendent of the Poole Engineering & Machine Co., Baltimore, Md., has resigned to accept a similar position with the Morgan Engineering Co., Alliance, Ohio.



CONSTRUCTION NEWS

OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Price advances are indicated by **heavy type**; declines by *italics*.

PIG IRON—Quotations compiled by The Matthew Addy Co.:

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$37.60	$37.60
Northern Basic	34.80	34.80
Southern Ohio No. 2	35.80	35.80
NEW YORK, Tidewater delivery		
Penna. 2X	39.55	39.55
Virginia No. 2	41.70	41.70
Southern No. 2	41.70	41.70
BIRMINGHAM		
No. 2 Foundry	34.00	34.00
PHILADELPHIA		
Eastern Pa. 2X	39.15*	39.15*
Virginia No. 2	40.50†	40.50†
Basic	36.90*	36.90*
Grey Forge	36.90*	36.90*
Bessemer	39.10*	39.10*
CHICAGO		
No. 2 Foundry Local	34.50	34.50
No. 2 Foundry Southern	39.00	39.00
PITTSBURGH, including freight charge from the Valley		
No. 2 Foundry Valley	35.40	35.40
Basic	34.40	34.40
Bessemer	36.60	36.60

* F.o.b. furnace. † Delivered

RAILWAY SUPPLIES

STEEL RAILS—The following quotations are per ton f.o.b. Pittsburgh and Chicago for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh		Chicago	
	Current	One Year Ago	Current	One Year Ago
Standard bessemer rails	$55.00	$38.00	$65.00	$38.00
Standard openhearth rails	57.00	40.00	67.00	40.00
Light rails, 8 to 10 lb	3.13½*	43.50	3.13½*	43.50
Light rails, 12 to 14 lb	3.09*	39.00	3.09*	39.00
Light rails, 25 to 45 lb	3.00*	30.00	3.00*	30.00

* Government price.

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh for carload lots together with the warehouse prices at the places named:

	Pittsburgh				San
	Current	One Year Ago	Chicago	St. Louis	Francisco
Standard spikes, ⅝-in. and larger	$3.90	$5.00	$4.50	$5.30	$6.15
Track bolts	4.90	7.00	5.50	Premium	7.50
Standard section angle bars	5.25	3.50	4.45	Premium	5.15

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

		7 In. x 9 In. by 8 Ft. 6 In.	6 In. x 8 In. by 8 Ft.
Chicago	Plain	1.48	1.33
San Francisco	Douglas Fir—Green	1.35	.96
San Francisco	Douglas Fir—Creosoted	2.70	1.92

Prices per tie at Missouri mills; St. Louis prices about 25c. higher:

Untreated A Grade White Oak 6x8x8		Untreated A Grade Red Oak 6x8x8	
No. 1	$0.70	No. 1	$0.55
No. 2	.80	No. 2	.65
No. 3	.90	No. 3	.75
No. 4	.98		
7x9x8 white oak	1.05		
7x9x8 red oak (No. 4)	$0.80	No. 5	.87

Note:—Add 36c. each for treatment.

PIPE

STEEL—From warehouses at the places named the following discounts hold for steel pipe:

	Black		
	New York	Chicago	St. Louis
⅛ to 3 in. butt welded	40%	*41.1%*	40%
¼ to 6 in. lap welded	36%	*37.1%*	36%
	Galvanized		
	New York	Chicago	St. Louis
⅛ to 3 in. butt welded	28%	*26.1%*	27%
¼ to 6 in. lap welded	25%	*23.1%*	24%

Malleable fittings, Class B and C, from New York stock sell at + 15% list prices. Cast iron, standard sizes, 5% off.

Note—There is an additional charge of 5% for cartage.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

	New York						
	Current	One Month Ago	One Year Ago	Chicago	St. Louis	San Francisco	Dallas
4 in.	$70.70	$70.70	$59.50	$69.80	$63.00	$85.50	$74.00
6 in. and over	67.70	67.70	56.50	66.80	60.00	82.50	71.00

Gas pipe and 16-ft. lengths are $1 per ton extra.

CLAY DRAIN TILE—The following prices are per 1000 lin. ft.:

	New York				
Size, In.	Current	One Year Ago	St. Louis	Chicago	San Francisco
3	$35.00	$35.00	$22.50	$30.00	
4	51.00	50.00	27.00	40.00	$45.00
5	65.00	65.00	45.00	50.00	65.00
6	90.00	90.00	55.00	60.00	90.00
8	130.00	130.00	100.00	80.80	150.00

SEWER PIPE—The following prices are in cents per foot for carload lots:

	New York					
Size, In.	Current	One Year Ago	St. Louis	Chicago	San Francisco	Dallas
3	$0.117	$0.093	.....	$0.125	$0.09	$0.138
4	.117	.093	.....	.125	.15	.138
5	.1755	.1395	.....	.175	.1875	.207
6	.1755	.1395	$0.16	.175	.225	.207
8	.273	.217	.22	.25	.3475	.2875
10	.4095	.3255	.30	.375	.45	.4025
12	.5265	.4185	.43	.475	.60	.5175
15	.702	.558	.65	.63	.9375	.78
18	.975	.775	.96	1.00	1.275	*1.08*
20	1.17	.93	1.14	1.20	1.71	*1.20*
22	1.56	1.24	1.46	1.60	.....	1.56
24	1.755	1.395	1.64	1.80	2.125	*1.80*
27	2.60	2.08	2.00	2.75	.....	*2.70*
30	2.88	2.304	2.70	3.45	.....	*3.30*
33	3.78	3.06	3.25	4.00	.....	*4.20*
36	4.305	3.485	3.55	4.35	.....	*4.80*

	3	5	8	12	24	36
Boston	$0.12	$0.18	$0.28	$0.54	$1.80	$6.75
St. Paul	.12	.18	.25	.45	2.00	4.75
Seattle	.15	.....	.33½	.64	2.00	.....
Kansas City	.12	.18	.25	.50	1.80	4.60
Los Angeles	.0825	.1375	.2475	.44	1.50	.....
New Orleans	.118	.132	.27	.459	1.75½	.....
Cincinnati	.108	.162	.252	.486	1.62	3.99½

ROAD AND PAVING MATERIALS

ROAD OILS—Following are prices per gallon in tank cars 8000 gal. minimum f.o.b. place named:

	Current	One Year Ago
St. Louis, 35% asphalt	$0.09	
Chicago, 15–20% asphalt	.10	$0.06½
Chicago, 100% dust layer	.11	.08½
Dallas, 40-50% asphalt	.09	.07
Dallas, 60-70% asphalt	.10	.08
Dallas, 75-90% asphalt	.11	.09
San Francisco, 75-95% asphalt	2.10	1.92

ASPHALTUM—Price per ton in packages and bulk in carload lots:

	Brand	Package	Bulk
Chicago	Mexican	$35.50	$33.00
San Francisco	California	16.50	13.50
Dallas	Texaco and Mexican	32.00	30.00
Seattle	D grade	23.10	.....
Denver	Trinidad	59.00	.....
Denver	California	39.00	.....
St. Louis	Stanolind	25.40	22.90
New Orleans	Mexican	30.00	26.00

PAVING STONE—

New York	Manhattan	$2.80 sq.yd.
	Other boroughs	2.80 sq.yd.
New York	5-in. granite	2.80 sq.yd.
Chicago	About 4x8x4 dressed	*2.70* sq.yd.
	About 4x8x4 common	*2.35* sq.yd.
San Francisco	Basalt block 4x7x8	57.75 per M
Kansas City	Limestone	2.75 sq.yd.
Boston	5-in. granite	*89.00* per M
St. Paul	Sandstone	1.75 sq.yd.

FLAGGING—

New York	Bronx	$0.20 sq.ft.
	Manhattan	.21 sq.ft.
	Queens, 5 ft. square	.20 sq.ft.
	5x20-in. cross-walk	.70 lin.ft.
Chicago	18 in. wide	*.80* lin.ft.

WOOD BLOCK PAVING—

	Size of Block	Treatment	Per Sq.Yd
New York	3½	16	$3.25
New York	4	16	3.50
Chicago	4	16	3.10
Chicago	3½	16	2.95
Chicago	City specifications		3.10
St. Louis	3½	16	2.45
St. Louis	4	16	2.60
St. Louis, Minneapolis spec	3½	..	2.40
St. Louis, Minneapolis spec	4	..	2.55
Seattle	4	16	2.15
Boston	4	20 per M	49.50
St. Paul	Minneapolis specifications		2.50
Dallas	3½	18	3.17
Dallas	4	18	3.56